The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

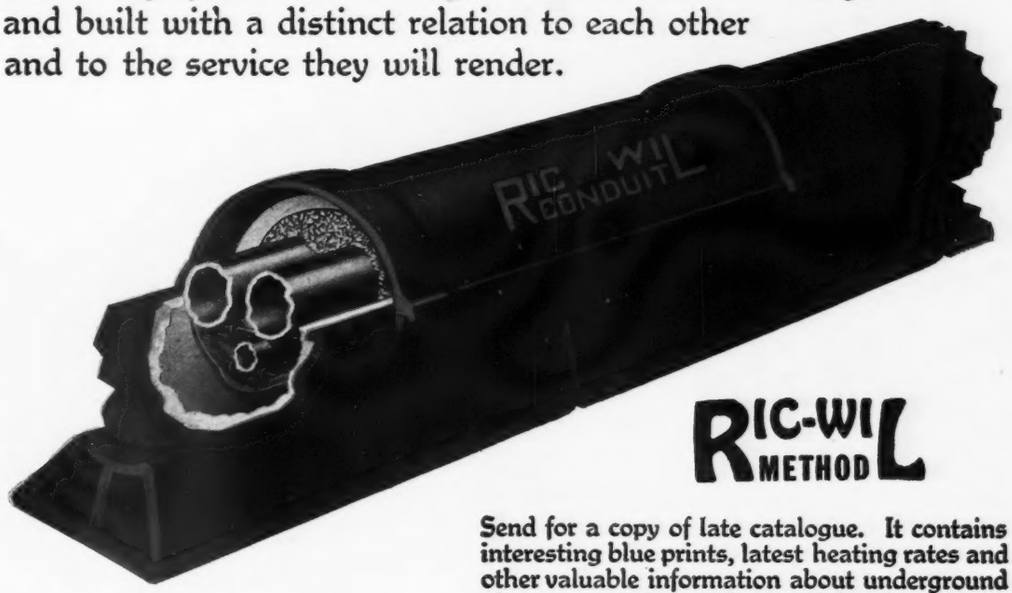
Vol. XIX. No. 2
$2.00 a year 20 cents a copy

FEBRUARY, 1922

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

SECTIONAL VITRIFIED TILE CONDUIT
for Insulating Underground Pipes

Used in the transmission of steam, hot water or oil, for power or heating systems, in which the various units are designed and built with a distinct relation to each other and to the service they will render.



RIC-WIL METHOD

Send for a copy of late catalogue. It contains interesting blue prints, latest heating rates and other valuable information about underground pipe construction and central heating plants.

THE RIC-WIL COMPANY
CLEVELAND

AGENTS IN PRINCIPAL CITIES

STANDARD ACCIDENT INSURANCE CO. BLDG. DETROIT, MICHIGAN

Architect—Albert Kahn, Detroit, Michigan
Heating & Vent. Contractors Johnson, Larsen & Co., Detroit, Michigan

CLARAGE
KALAMAZOO

MULTIBLADE FANS INSTALLED IN THIS OFFICE BUILDING

MANY times Clarage Kalamazoo Multiblade Fans are chosen not only because of their large capacity, low speed and economy of operation, but because, above everything else, this equipment is dependable.

These fans are so built and so constructed that they will render years of faithful service, without the necessity for any repairs. Hundreds of installations in all types of public buildings and in industrial plants bear evidence that Clarage Fans *are dependable.*

A complete Clarage Multiblade Fan System for heating, ventilating and humidifying is now operating in the new Standard Accident Insurance Co. building in Detroit.

Our Engineering Department will gladly place before you all the data and statistics we have compiled. Allow us to send you Catalog No. 52.

CLARAGE FAN COMPANY

Branch Offices in Principal Cities

HOME OFFICE & WORKS at KALAMAZOO, MICHIGAN

Dunham
Return Heating System

The Dunham Return Heating System is particularly adapted for buildings where no exhaust steam is available. It is designed to operate on low pressure, and is effective on a pressure of ounces.

The ability of this Dunham system to operate with any pressure up to ten pounds, is made possible by the Dunham Return Trap, in conjunction with the Dunham Radiator Trap and other Dunham Specialties.

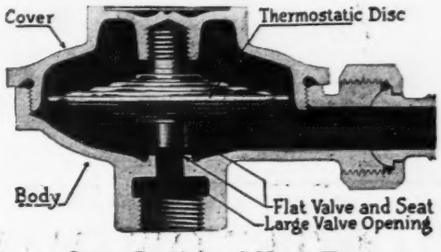
DUNHAM Specialties

Packless Radiator Valves
Radiator Traps
Drip Traps
Blast Traps
Air Line Valves
Vacuum Pump Governors
Reducing Pressure Valves
Oil Separators
Suction Strainers
Air Vents
Return Traps
Check Dampers
Damper Regulators

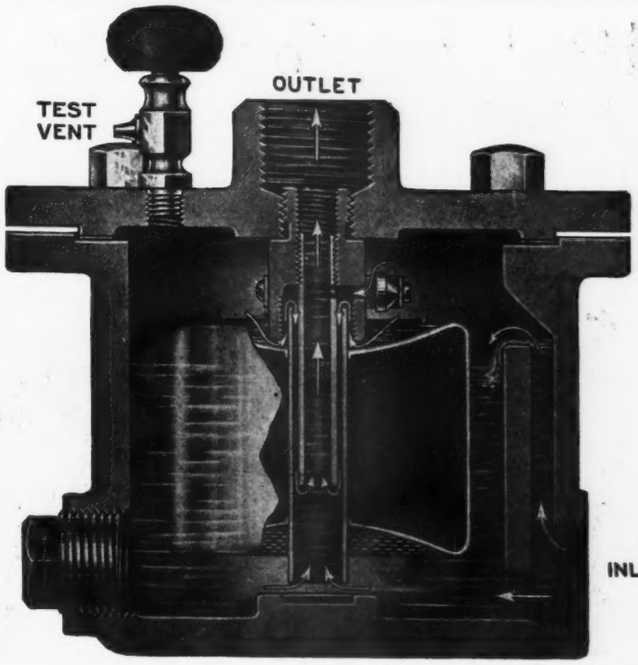
The DUNHAM REG. TRADE-MARK HEATING SERVICE

C. A. DUNHAM COMPANY
230 East Ohio Street, Chicago

52 Branch and Local Sales Offices in United States and Canada



Cross Section of No. 2 Trap



MARSH
DUPLEX WATER SEAL LOW PRESSURE
BLAST TRAP

FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

FOUNDED 1865

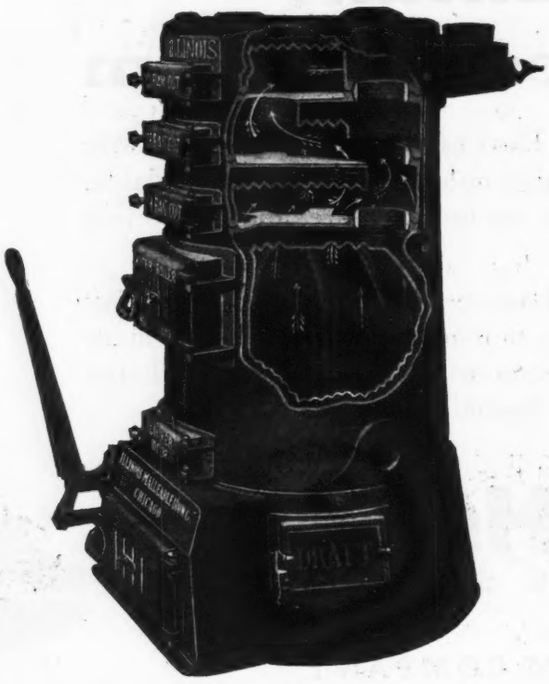
Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents
Indicating and Recording Gauges

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

IMICO HEATING BOILERS

For Water and Steam

Various Sizes



Imico Vacuum Heating System

Write For Catalogue

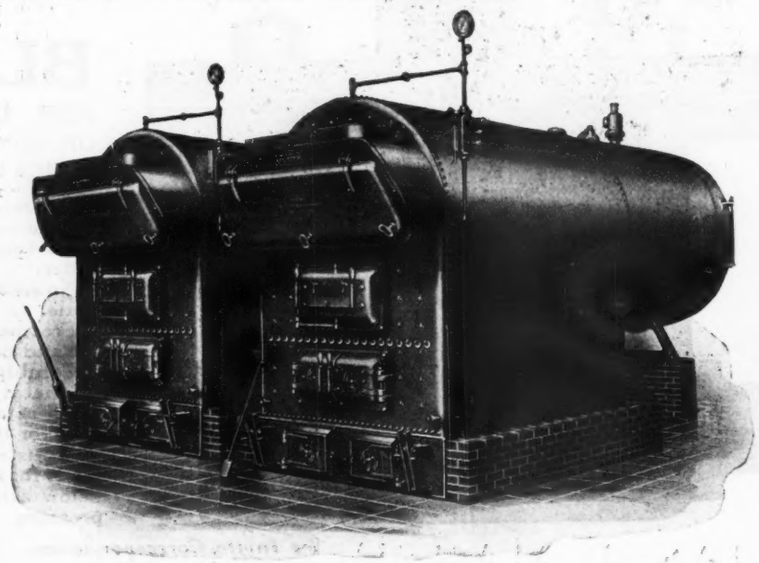
Manufactured by

ILLINOIS MALLEABLE IRON CO. Chicago, Ill.

"Oil City" Boilers for Heating

Return Tubular Portable Firebox

Will burn any kind of fuel,—hard or soft coal, oil, gas or lignite. Note use of high firebox, giving ample combustion area to make possible the use of low-grade fuels.



Why "Oil City" Boilers are Ideal for Heating Work:

These boilers are adaptable for Apartments, Churches, Club Houses, Court Houses, Hospitals, Garages, Hotels, Office Buildings, Large Residences, Post Offices, Schools, etc., because they are Safe, Efficient, Dependable, and, being Self Contained, require little attention.

Circular H-7 gives Full Specifications, Ratings and Weights

Built of Steel, in Accordance with the A. S. M. E. Code

OIL CITY BOILER WORKS, OIL CITY, PA.

BRANCH OFFICES

NEW YORK, 501 Fifth Ave. CHICAGO, No. 1224 Marquette Building PITTSBURGH, House Building

REPRESENTATIVES

CLEVELAND, OHIO PHILADELPHIA, PA. SEATTLE, WASH. BALTIMORE, MD.
SAN FRANCISCO, CAL. ST. PAUL, MINN. DENVER, COL. HOUSTON, TEXAS

KEWANEE

Arrives on the Job in ONE Piece

When a Kewanee Boiler is to be used be sure to leave an opening large enough to get it into the basement. Kewanee Boilers can't be taken apart. They arrive on the job ***in one piece*** and they go into the basement ***in one piece.***

So, if the Kewanee Boiler is to go in after the walls are up, be sure an opening is left big enough to get it in.

Complete specifications and measurements with exact setting plans are shown in our catalog. The latest is No. 76, issued May, 1921. If you haven't a copy one will go on request.

KEWANEE BOILER COMPANY
KEWANEE, ILLINOIS

Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

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CHICAGO	Market and Washington Sts.	SALT LAKE CITY	Scott Bldg.
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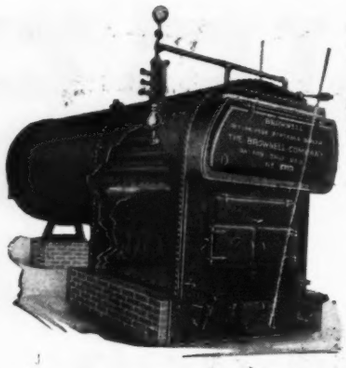
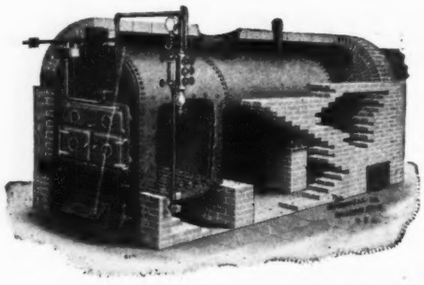
INDIANAPOLIS	509 Occidental Bldg.	DETROIT	1772 Lafayette Boul.
ST. LOUIS	1212 Chemical Bldg.	TOLEDO	1121 Nicholas Bldg.
MINNEAPOLIS	708 Builders Exchange	CLEVELAND	706 Rose Bldg.
COLUMBUS, O.	808 1st Natl Bank Bldg.	ATLANTA, GA.	1524-25 Candler Bldg.
		SAN FRANCISCO,	72 Fremont St.

CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.
Toronto, Ont., Montreal, Que., Winnipeg, Man., Hamilton, Ont., St. John, N. B., Calgary, Alta.



Brownell Return Flue Portable Fire Box Heating Boiler—Direct Draft Type



Brownell Fire Box Heating Boiler

Put it up to Brownell

Brownell has the three requisites in the manufacture of any superior article—***Long Experience***, ***Ample Facilities*** and a ***Determination to Make the Best.***

And the Brownell organization, to a man, feels that its reputation and its prestige imply an obligation that is akin to a religion—that everything can be sacrificed better than a lowering of its standards of workmanship.

It would be safe to assume that such practical adherence to a principle plus the cumulative experience of 66 years would be reflected in the quality of the product and, through it, in satisfaction to the buyer.

It follows only naturally that Brownell has a legion of friends who depend upon it for service and for assistance. It pleases us to render this assistance. We like to have it "put up to Brownell." Let us help you, too, with your heating problems.

The Brownell Co., Dayton, O.

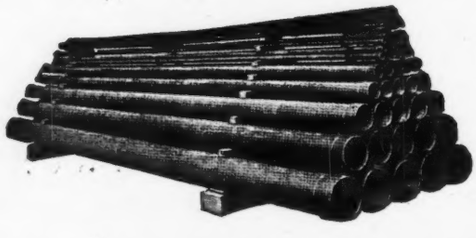
ESTABLISHED 1855

JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
MILL
and
FACTORY SUPPLIES



STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request

WHETHER it be the smallest auxilliary pipe fitting on a drainage or heating system, or an especially designed and constructed fitting for the transmission of acids or high pressure steam in an enormous power plant,

CRANE SERVICE

stands ready to fulfill the most exacting demands, and is conveniently located in more than one-hundred branches, offices and exhibit rooms in the leading cities throughout the country.

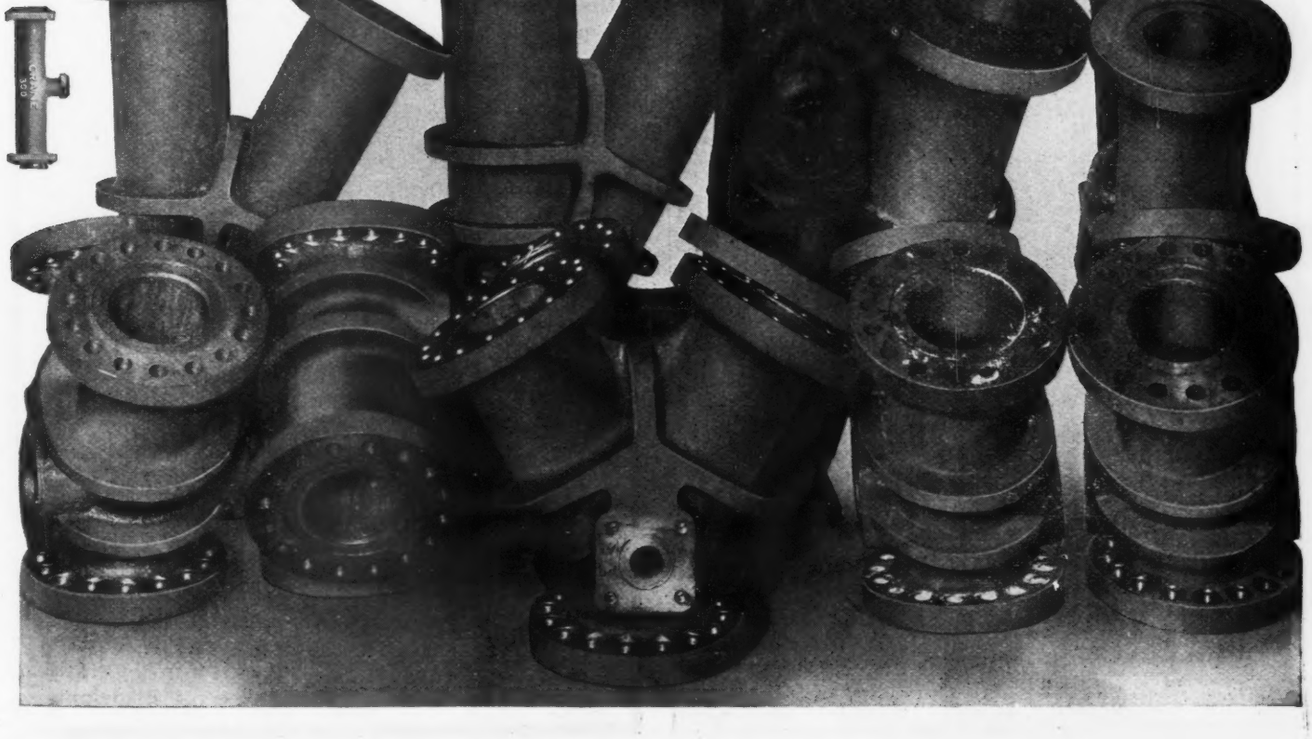
We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes and are distributors through the trade of pipe, heating and plumbing materials.

1855 — **CRANE CO.** — 1922

836 South Michigan Avenue, Chicago

You are cordially invited when in Atlantic City to make the Crane Exhibit Rooms (1105-1107 Boardwalk) your headquarters. We will be glad to receive any mail addressed to you in our care.

Works:-
Chicago, Ill. and
Bridgeport, Conn.



ECONOMY
REG. U.S. PAT. OFF.
SMOKELESS BOILERS

Simplicity and Ease of Operation

It will be readily conceded that the boiler that is most simple and easy to operate, that does not require an expert fireman, is the one that most completely answers the public demand.

The ECONOMY SMOKELESS is a single grate up draft boiler, fired like the general run of flat grate boilers with which all janitors are familiar. It does not require an expert fireman; it is not limited to one special method of firing nor to a particular grade of coal.

This one feature–simplicity and ease of operation–entitles it to your consideration.

Take up your Smokeless Boiler requirements with us and let us explain all the other good points of the Economy.

Send for catalog 1436-H and folder showing our free advertising aids.

INTERNATIONAL HEATER COMPANY
MAIN OFFICE AND FACTORY
UTICA, N. Y.
BRANCHES:
New York Chicago Greensboro, N. C. Nashua, N. H.

"Wainwright" Floating Head Service Heaters

The Interior Construction of the Wainwright Vertical Floating Head Heater

Built in Vertical or Horizontal Patterns—Temperature Control Furnished if Desired

Ask for Bulletin

Consult Our Engineering Department

ALBERGER PUMP & CONDENSER CO.
140 Cedar Street, New York
Boston Chicago St. Louis Philadelphia

THE best insurance against expensive and troublesome heating boiler leaks is a can of SHUR-TITE.

It is easy to use because it is in powder form.

Simply pour it in the boiler and start the fire. SHUR-TITE will do the rest.

Your Jobber will supply you and supply some interesting facts relative to SHUR-TITE'S success.

Ask him.

SHUR-TITE

Good territory still open for live Representatives

Make Your Own

WEATHER making in industrial plants is a paying proposition in many ways.

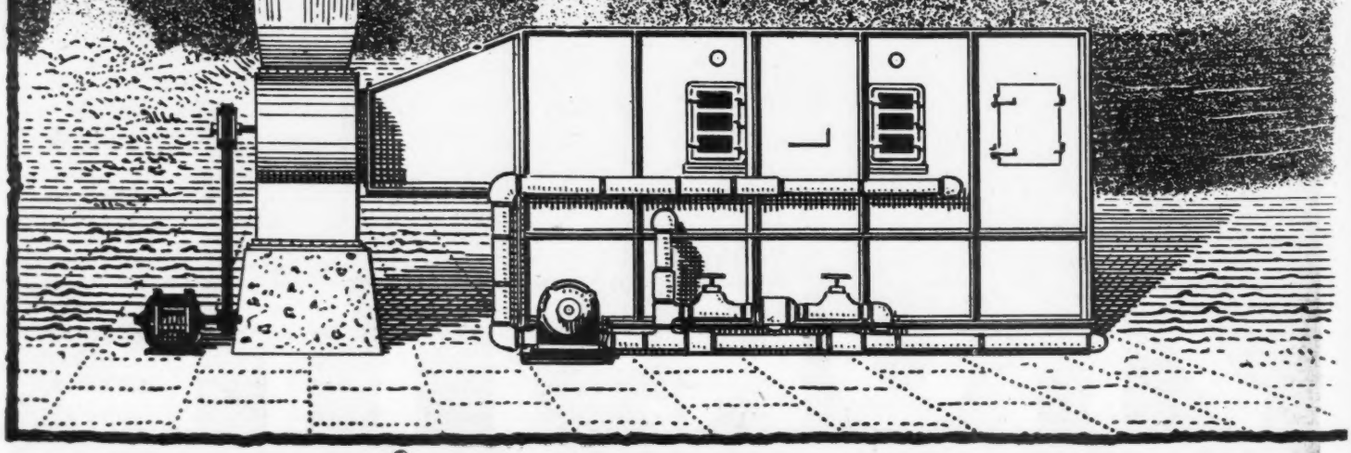
Obviously your office and factory buildings would be better places in which to work, if on a hot humid summer day you could maintain a circulation of cool, dry air. This kind of weather making pays in better work from your workers and better health for them.

But the application of weather making to your process itself is where it pays the most.

Your process equipment will produce better results under certain conditions of moisture, or dryness; of heat or cold. Often you cannot get satisfactory results during certain outside weather conditions. Today you cannot afford any but the best results.

Atmospheric Condit

Lafayette Building



Weather—
It Pays!

Making the weather inside your plant as you need it regardless of outside conditions will solve these difficulties. It will maintain sufficient heat or ample cold. It will keep your process air dry or moist in any degree. And the *exact* conditions you require will be maintained day in and day out the whole year through.

Wasted materials no longer lost will make this weather making pay. So will the increased quality of your product.

Webster Air Conditioning Apparatus is installed in hundreds of office buildings, power plants, manufacturing plants, theatres, etc., all over the country.

You can make your own weather at will—Ask us how it is done. Write today for detailed information

ioning Corporation

Philadelphia

Equipment for maintaining artificial atmospheric conditions in Industrial Plants
Humidifying—Dehumidifying—Cooling—Drying—Cleansing
Webster System of Automatic Humidity Control
BRINE SPRAY REFRIGERATION

J. Hog.

Extension of Engineering Service

IN PROBLEMS OF HUMIDIFICATION, AIR-CONDITIONING, HEATING, VENTILATING

William G. R. Braemer Joins American Moistening Company's Staff

The American Moistening Company announces that from January 1st, William G. R. Braemer of Philadelphia, becomes chief engineer of the company with headquarters in Boston and will serve in an engineering capacity pertinent to the greater development of the company's air conditioning, heating and ventilating problems.

Mr. Braemer is a pioneer in this field and is an inventor of numerous United States and foreign patents in connection with air washing, humidifying, dehumidifying, cooling and drying systems. For nine years he was in charge of this branch of the business of Warren Webster & Company at Philadelphia and for the past three and a half years has been engaged as consulting engineer, specializing in air conditioning.

He is a member of the American Society of Mechanical Engineers and a member of the American Society of Heating and Ventilating Engineers in which he is particularly active.

Mr. Braemer is a graduate of the College of Technology of Copenhagen, a practical mechanic, and previous to organizing the air conditioning department of Warren Webster & Company, was for over nine years chief engineer of the Buffalo Forge Company.

He has made air conditioning a life study and has personally worked at every detail of the business and brings to his new connection a wide experience gained in professional work in humidification.

AMERICAN MOISTENING COMPANY

Boston, Mass. — *Russell Grinnell, Pres.*

Atlanta, Ga. — *Frank B. Comins, Gen. Mgr.*

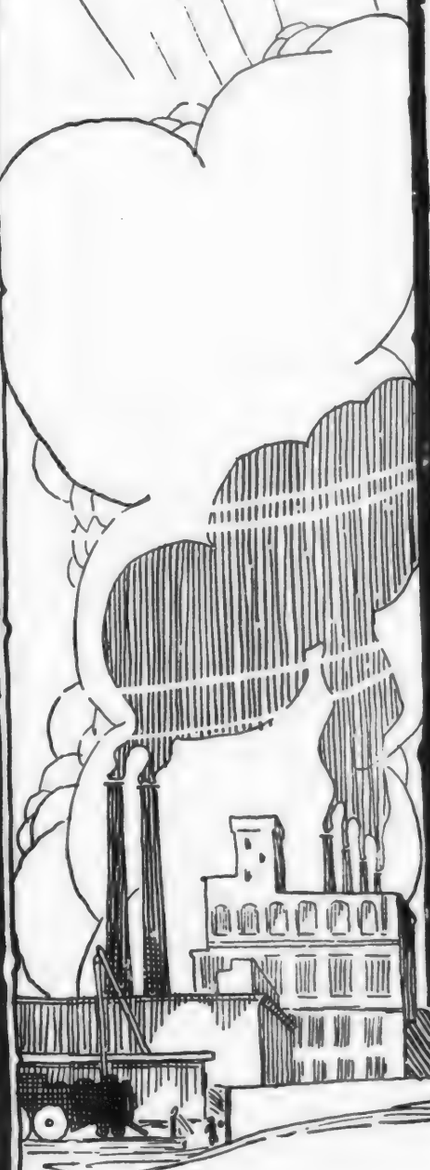
Foreign Representatives

W. R. Grace & Co., New York (So. America)

Andersen, Meyer & Co., Ltd., Shanghai, CHINA

W. J. Westaway Co., Ltd., Hamilton, Canada

Hot or Cold
Wet or Dry



No Direct Spray Heads Used

Still another feature of the Sturtevant-Fleisher Air Conditioning System.

In the Sturtevant-Fleisher Air Conditioning System no direct spray heads are used in the departments themselves. This is still another reason why Sturtevant-Fleisher Systems are of more economic value than many other so called methods of temperature and humidity systems.

With spray heads, it is impossible to get an even distribution of the introduced moisture all over the department and in addition, there is still greater objection of having water sprayed into the room, not as the vapor of the atmosphere, but as "free water."

Free water causes rusting, the ruination of machinery. It is more than likely to cause cause rotting of the timbers and often it results in dripping, which not only interfers with the operation of the machinery but often damages the product.

B. F. Sturtevant Company
Hyde Park - - - - - Boston

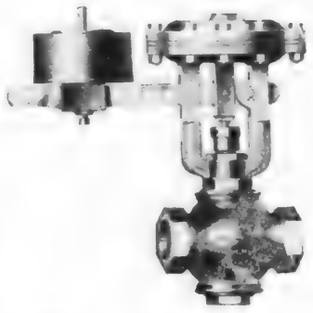
W. L. Fleisher & Co. Inc.
New York City

Design and Install
All
Sturtevant-Fleisher
Air Conditioning System

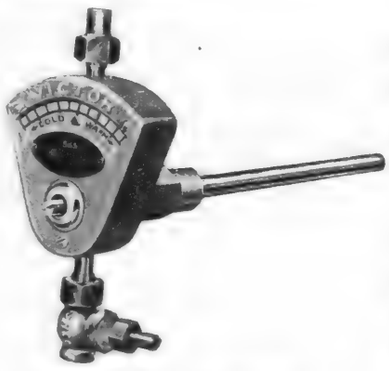
Sturtevant
PUTS AIR TO WORK

For Heating and Ventilating Engineers

Now Being Printed
A Valuable New Hand-book
It Tells How to Figure and Buy
Reducing Valves Scientifically.
Use the Coupon Below and



Vacuum Pump Governor and Pressure Regulator. ATLAS. For regulating pumps for vacuum heating systems or wherever a uniform vacuum is wanted.



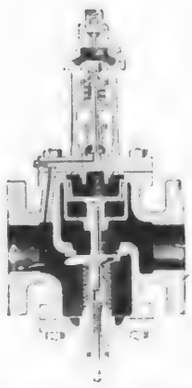
Hot Water Tank Regulator. VICTOR. All metal. Not self-contained. Simple. Indestructible. Very sensitive.

We will be glad to send a copy, FREE, to any responsible engineer or architect or plumber or contractor, as soon as it is off the press.

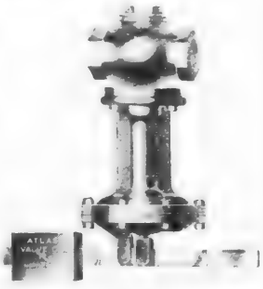
No more GUESS WORK
" " RULE OF THUMB
" " OVERSIZE VALVES
" " EXCESSIVE PRICES
" " UNDERSIZE VALVES
" " CUTTING AND TRYING

until the right size or an oversize valve is finally found. A booklet that every purchaser of Reducing Valves NEEDS.

The Handbook deals with Reducing Valves and Pipe Connections only. It is very compact—very handy—only 28 pages. You can carry it around in your inside coat pocket or in your vest pocket, or, just keep in a convenient place in your desk.



Reducing Valve. ATLAS. The Handbook mentioned in this advertisement tells how to figure and how to order these valves SCIENTIFICALLY.



Type "C" Reducing Valve. For low pressure heating systems. Atlas Junior catalog No. 21 tells all about it. Use the coupon below.

TEAR OFF OR CUT HERE

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

281 SOUTH STREET
NEWARK, N. J.

☐ Please send the above handbook without obligating me in any way.

☐ Please send ATLAS Junior Catalog No. 21 describing your complete line—Reducing Valves, Pump Governors, Balanced Valves, Pressure Regulators, Control Valves, Damper Regulators, Hot Water Tank Regulators, Float Valves, etc.

Name..... Firm.....

Address.....

At Last!

A SINGLE PIPE VAPOR SYSTEM

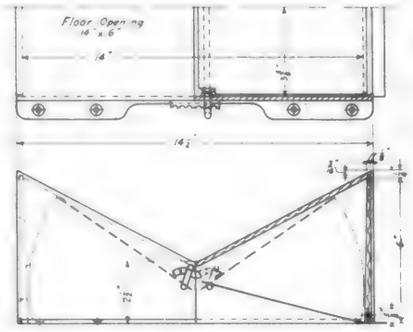
Simple to install
Efficient in operation
Low in cost

Descriptive matter sent on request

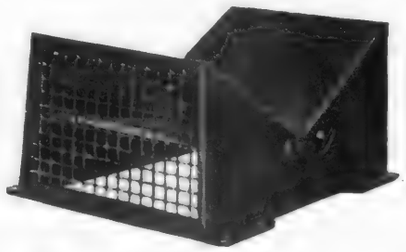
GORTON & LIDGERWOOD CO.

96 Liberty Street, New York

FISHER BUILDING, CHICAGO, ILL.



"Camel Back" Air Diffuser



Its Advantages

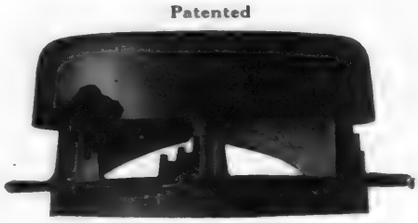
In securing distribution of fresh air in theatre, school and church auditoriums.

1. With the "Camel back" Air-Diffuser less duct work is required—saving a great expense in masonry.
2. Its construction of two-way air delivery at ends permits the discharge of the *maximum quantity of air with the minimum number of diffusers.*
3. Its angular shape makes it uncomfortable as a foot rest.
5. Friction loss negligible.
6. Admits of the use of the *lowest* slung chair seat.
7. Made of cast iron with coarse wire screen over ends.
8. It is fool proof.
9. Has two air controlling dampers, which are regulated independently of each other.

As Architects and Engineers have shown individual preference for different methods of adjustment in ventilation we have evolved, through a number of years of study on the subject, several distinct styles, two of which are shown at the bottom of the page. We would like to send you some interesting facts concerning the Knowles products in connection with Auditorium Ventilation. They are yours for the asking.

Knowles Mushroom Ventilator Co., 202 Franklin St., New York.

Patented



Knowles "Notch" Air Diffuser

Full size blue prints and prices on request.

Knowles "Aisle Hood"

OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

RESULTS

Pure air in rooms, free from organic odors and impurities.

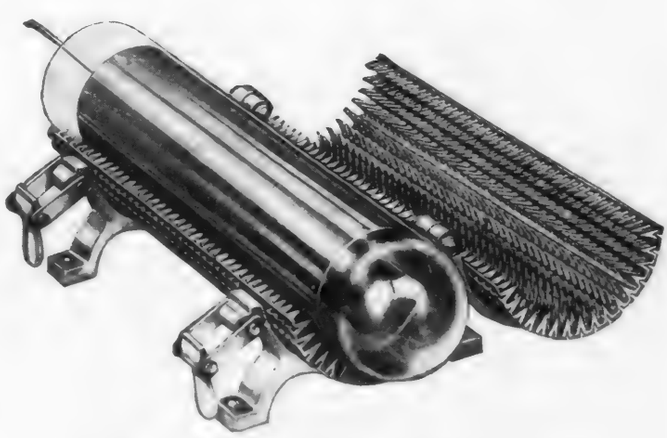
The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

We will be pleased to send literature on this subject to anyone interested,

Ozone Pure Airifier Co.

1403 W. Jackson Blvd.

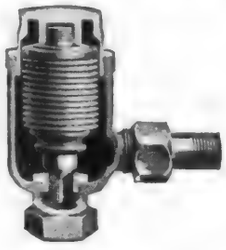
CHICAGO, ILL.



One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

QUALITY SERVICE QUALITY

Heating Specialties that Last



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In specifying the B. & B. Line of Heating Specialties for vacuum systems and Temperature Control Systems you are assured of getting QUALITY-SERVICE and a Heating Specialty that will last.

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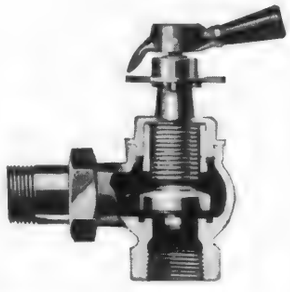
Literature sent upon request.



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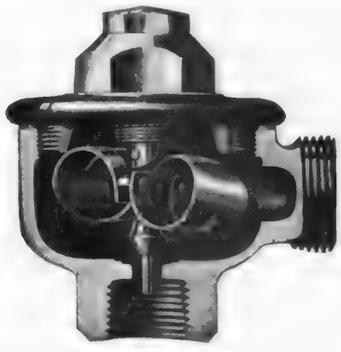

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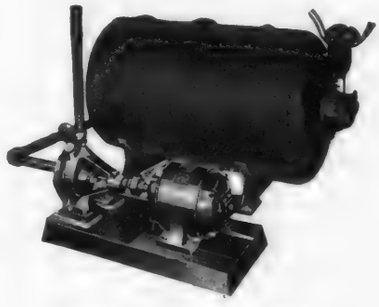

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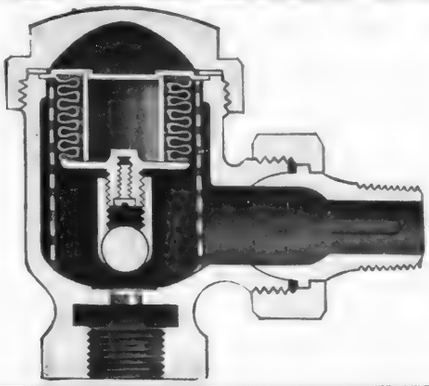

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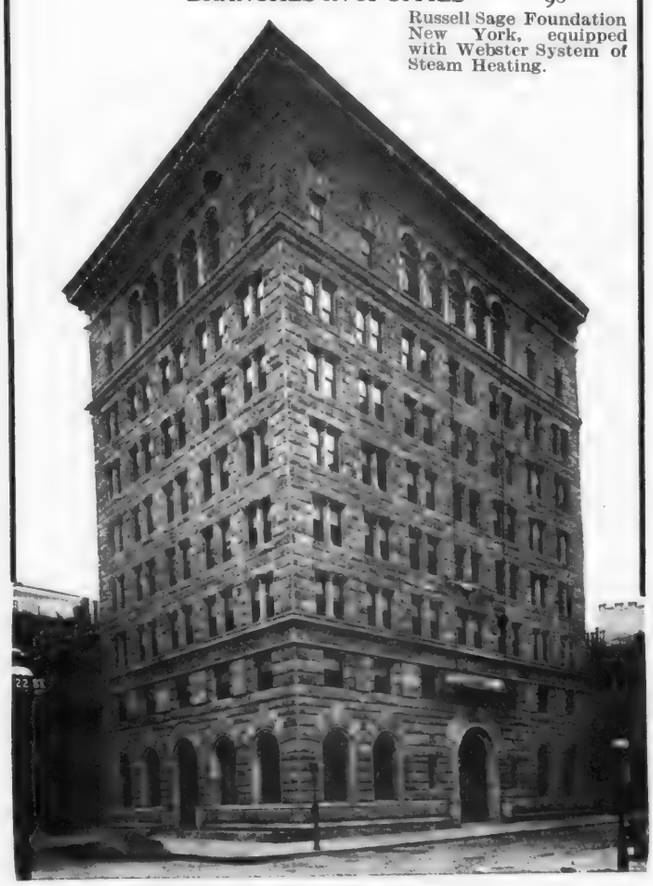

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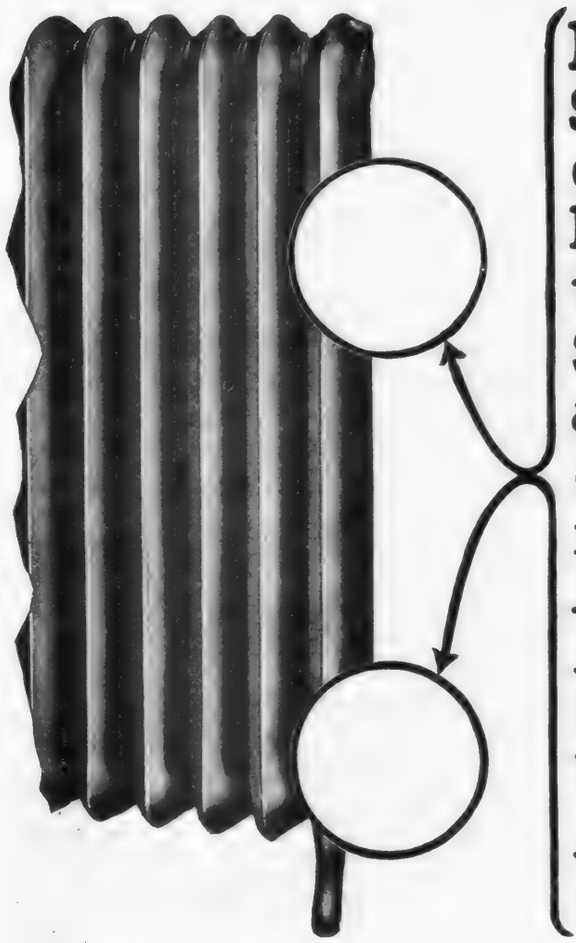

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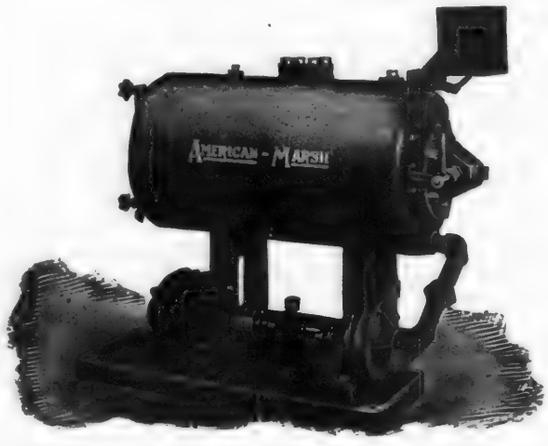

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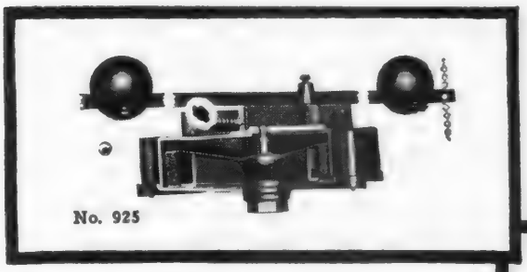

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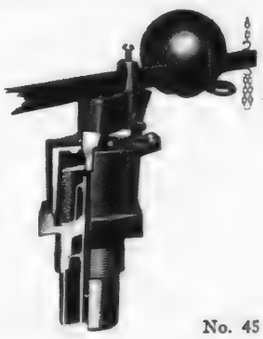

No. 45 A

No. 22

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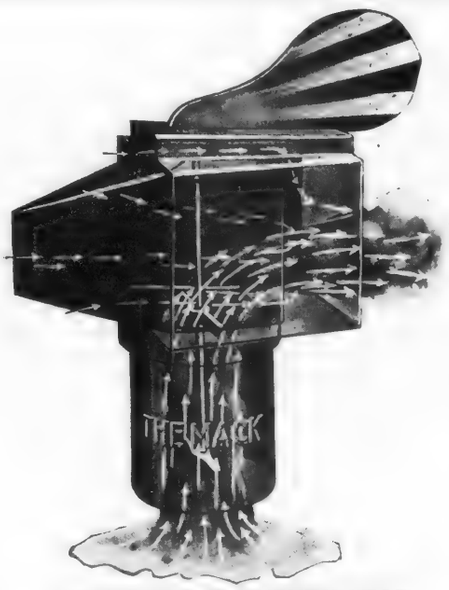

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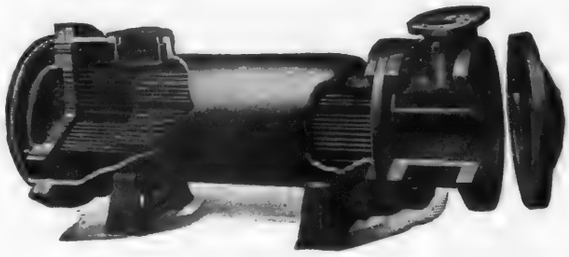

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12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
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36 "	281,000	330,000
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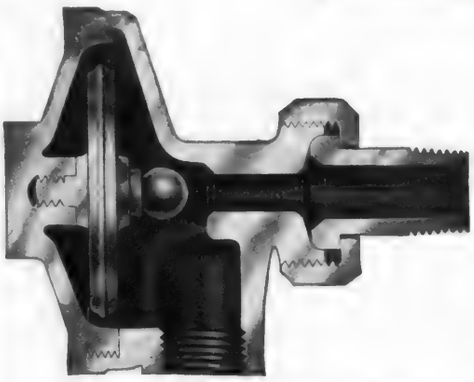

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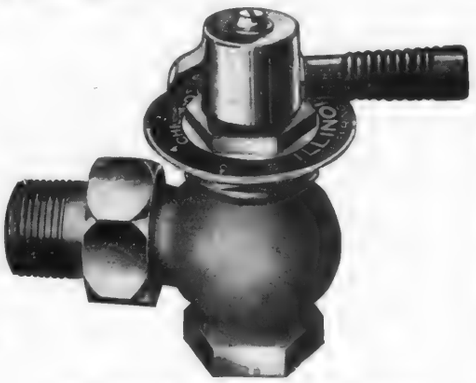

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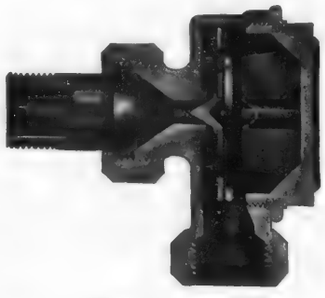

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Published monthly at Cooperstown, N. Y., by the Heating and Ventilating Magazine Co.
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Horizontal slow speed Spencer Turbine vacuum cleaning exhauster. Direct motor driven, wide clearance, multistage type equipment.

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A MONTHLY JOURNAL OF ENGINEERING PROGRESS

FEBRUARY, 1922

UP-DRAFT VERSUS DOWN-DRAFT SMOKELESS BOILERS

New Light on a Point That Has Aroused Much Discussion Among Combustion Engineers

EDITOR'S NOTE.—*A recent statement in these columns of the reasons that led three manufacturers of down-draft boilers to change their designs during the past year to the up-draft type brought forth strong rejoinders that the down-draft principle was too thoroughly proven and established to permit of its being questioned at this late day. In the accompanying article some interesting facts are presented which, we feel, tend to harmonize many of the contradictory opinions held on this subject.*

AMONG engineers interested in combustion problems quite a controversy has been waged the past few months in regard to the merits of the new air-intake devices designed for the smokeless combustion of soft coal in low-pressure heating boilers.

Several years ago the down-draft furnace was applied to cast-iron boilers, and, so far as the down-draft principle was involved, it has been eminently successful, although there have been, of course, some cases of only modified success due to faulty application of the principle.

The discussion on this subject is reminiscent of the arguments which were indulged in for and against air-admission types of furnaces, which were introduced in the power plant field, when the question of smoke abatement first assumed importance. At that time quite a number of furnaces designed to permit the introduction of secondary air were put on the market, and the advocates of each were just as enthusiastic over its advantages as are the advocates of the same ideas when applied to cast-iron boilers.

Attempts were made to introduce air into the furnace at every imaginable point along the route of the gases of combustion, from the firebox to the breeching. These furnaces were all more or less successful as smoke prevention devices, when operated by expert firemen who recognized the limitations of the devices and operated each furnace in the manner calculated to produce the best results. When placed in the hands of inexperienced or careless operators, however, their smoke results were more than doubtful, and the economic results were such that this class of smokeless furnace soon disappeared from the high-pressure field to be replaced by other types.

AIR OVER FIRE NEEDED ONLY PART OF THE TIME.

There is no doubt that, in order to burn completely the volatile matter, which is distilled from soft coal when it is thrown into a hot firebox, it is necesssary to supply air over the fuel bed. It is a very well-established fact that no more than about a third of the air necessary for the combustion of soft coal can be drawn through the grates. It is necessary, therefore, for good results, to introduce air to the fire-box at some point where it can be mixed with the volatile gases while these gases are being distilled, and, in so far as any furnace meets with this requirement, one of the essentials of complete combustion is being complied with.

A point, however, which seems to be lost sight of by the builders of air-admission furnaces, as applied to low-pressure boilers, is that this air is only needed during the time that the volatile matter is being distilled from the coal and that its supply should be shut off during the time that the carbon or coke is being burned.

Let us assume that we are firing a boiler which requires 100 lbs. of coal every two hours and that we are using an average East Kentucky coal containing about 35% volatile matter. This 100 lbs. of coal would require about 2000 lbs. of air for its complete combustion, of which 60%, or 1200 lbs. is required for the volatile and 8% or 800 lbs. for the carbon.

RATE AT WHICH AIR IS DEMANDED.

The accompanying chart shows the rate at which this air is demanded under the conditions stated. It will be noted that the air demand rises rapidly, when the coal is first fired, to a rate of 90 lbs. per minute and then decreases, at first rapidly and then more slowly, until, at the end of about fifty minutes, the rate has decreased to about 8 lbs. per minute. Now, as air is supplied at a rate necessary to burn the gases smokelessly at their point of greatest distillation, namely, at a rate of 90 lbs. per minute during the complete cycle of combustion, then the excess of 90 lbs. times 100 min. equals 9000 lbs. of air admitted. while the carbon is being burned, though, during this stage of combustion, only 800 lbs. should be admitted, making an excess of 8200 lbs., or 1025%. The loss due to this excess air is approximately 20%.

In furnaces not equipped with any sort of smoke prevention or air admission device the air admission, as shown by the lower dotted line on the chart, and a loss due to insufficient air, is represented by the area "A," under the peak of the curve, and represents an 83% deficiency of air supply, or, a loss in fuel of about 2%.

With the down-draft furnace, the coal being fired into a relatively cool fire-box and progressing first into a zone of slow distillation and then into a zone of more rapid distillation down to the lower firebox, in which the carbon is burned, the air demand is practically constant, so that no manipulation of an air-admitting device is necessary; and neither of the losses mentioned above are found in a well-designed and properly-operated down-draft furnace.

VALUE OF PRE-HEATING AIR DOUBTFUL.

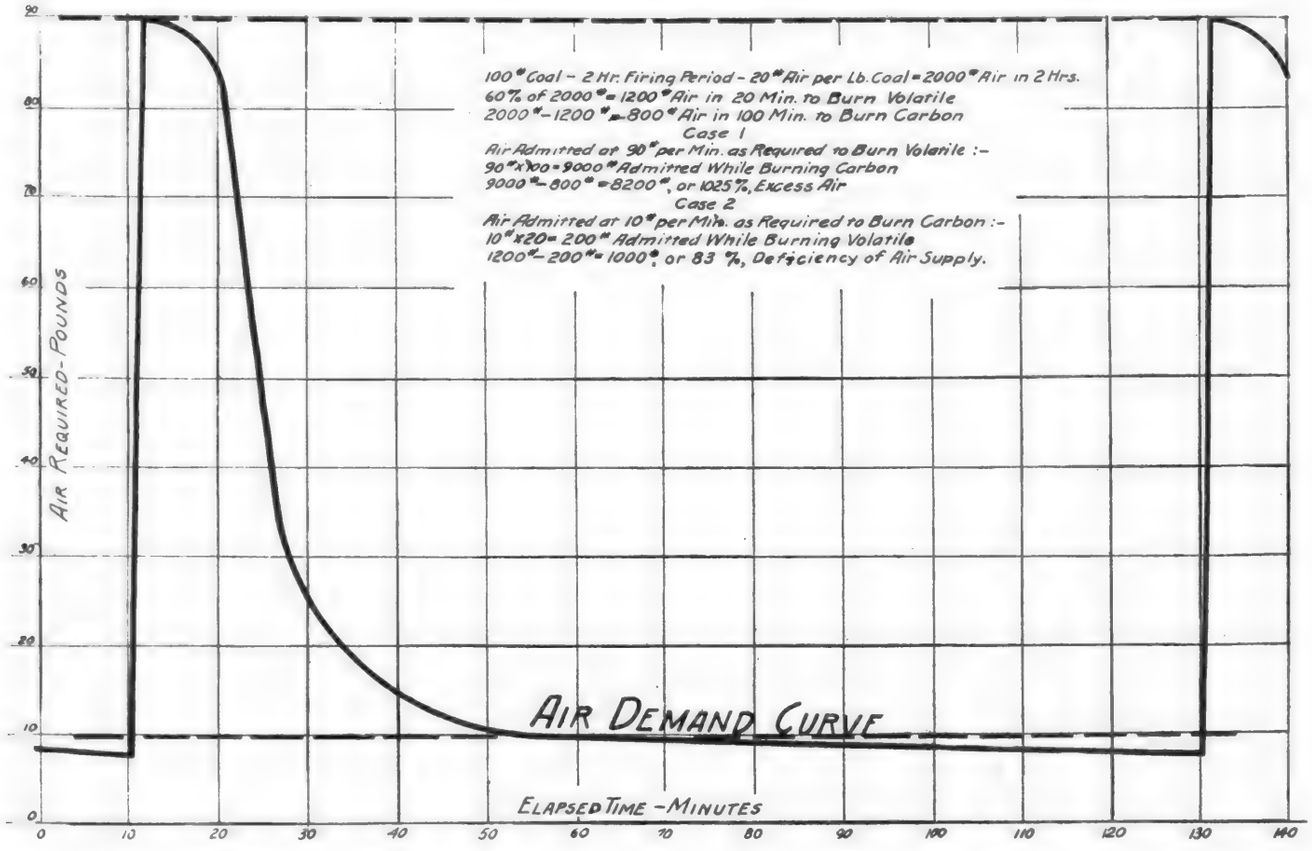
The theory that a great virtue is derived from the pre-heating of the air is apt to be misleading; at least there is a very well-defined doubt in the minds of some engineers who have studied this problem as to the value of introducing hot air into the fire-box. In fact, putting this air into a fire-box at a low temperature has the very obvious advantage that a greater weight of air can be introduced in a shorter time at the low temperature, because of the fact that its volume is less. And it is also sometimes contended that the cold air going into the fire-box and immediately expanding to several times its original volume, on account of this great expansion, will mix more intimately with the gases and air already in the fire-box.

We must also not lose sight of the fact that the heat for pre-heating any air used in the combustion is derived from the coal itself and that there is nothing that the pre-heating of the air can add to the total amount of heat generated by the coal.

STRAIGHT FIRING COMPARED WITH THE "COKING" METHOD.

In a down-draft furnace properly designed, with space for a deep fire bed on the upper grate and sufficient depth between the grates to admit a proper thickness of fire on the lower grate and free and unrestricted travel of the gases, the operation of the boiler, as compared to the boiler which must be fired by the coking method, is comparatively simple, principally for the reason that the progress of the coal from the upper fire-box to the lower is in the direction of gravity, while, in firing according to what is called the "coking" method, it is first necessary to fire the coal into the front end of the fire-box and then a short time later to push this coal back the length of the grates to the rear end of the fire-box.

Disregarding the diculty of gauging the relative thicknesses of two different kinds of fuel beds in the same fire-box, the simple operation of pushing back 300 or 400 lbs. of coal with a small hoe, while exposed to the radiant heat from the fire-box, and the gases of combustion which escape from the door to some extent, is anything but an alluring prospect to the average fireman, and the chances are that this method of firing will have to give way to the good, old-fashioned method of heaving the coal into the fire-box.


100# Coal – 2 Hr. Firing Period – 20# Air per Lb. Coal = 2000# Air in 2 Hrs.
60% of 2000# = 1200# Air in 20 Min. to Burn Volatile
2000# – 1200# = 800# Air in 100 Min. to Burn Carbon
Case 1
Air Admitted at 90# per Min. as Required to Burn Volatile :–
90# x 100 = 9000# Admitted While Burning Carbon
9000# – 800# = 8200#, or 1025%, Excess Air
Case 2
Air Admitted at 10# per Min. as Required to Burn Carbon :–
10# x 20 = 200# Admitted While Burning Volatile
1200# – 200# = 1000#, or 83 %, Deficiency of Air Supply.
AIR REQUIRED - POUNDS
AIR DEMAND CURVE
ELAPSED TIME - MINUTES
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

RATE AT WHICH AIR IS NEEDED IN OPERATION OF BOILERS BURNING SOFT COAL.

THE "READY-TO-SERVE" CHARGE IN STEAM HEATING

With a Comparison of Various Radiation Formulas and Reasons Why More Efficient Installations Benefit Both Customer and Utility

BY MALCOLM C. W. TOMLINSON,
Consulting Engineer.

THERE is a growing disposition on the part of all utilities to adopt a two-rate system of charging for service and there can be no doubt that this method is more equitable than any other system used, providing accuracy is shown in arriving at the maximum demand. In the electrical field the demand meter has been rapidly introduced but in the steam heating field commercial demand meters have not arrived and various rules are used to figure the so-called "theoretical" heating requirements. As it is necessary for a heating company to have some standard method to figure heating requirements, if only to prevent customers from having insufficient radiation troubles, many rules have been devised and used. In an effort to effect a national standardization and to introduce a greater accuracy the National District Heating Association, in 1919, adopted a long, or B. T. U. rule and a short rule. It is possible that this action will greatly aid the introduction of the ready-to-serve, or maximum demand, charge for heating and also do much toward securing accuracy in figuring heating.

MAXIMUM DEMAND CHARGE MISUNDERSTOOD BY PUBLIC.

The maximum demand charge has been misunderstood by the public who have largely accepted it as an unjust charge which has been "put across" on the city fathers and the utility commissions. This viewpoint can be corrected in time by education but, in the meantime, it is more than necessary for the public utility in the heating field to exercise the greatest care that its methods are above criticism.

There is no question that the difficulties involved in a ready-to-serve charge for steam service are great. Without a meter to obtain the maximum demand the heating requirements must be calculated. The general practice of contractors, engineers and utility companies for years has been to use rule-of-thumb methods or rules which had only one virtue—they could be used at a minimum expense of time. But all such rules have resulted in great absurdities and inaccuracies which have caused much waste of coal and steam, much useless investment in equipment and a serious doubt on the part of the public as to whether anyone really knew how to figure heating. In the hands of men with a vast practical and technical experience they can be made to give results by "cutting and fitting" but the men who have had such experience are rare.

As stated before, the N. D. H. A. long rule is a step in the right direction but it is vague on some points and gives results which are inaccurate and too high. It is true that the maximum demand portion of a heating bill only represents, under usual conditions, from 1% to 10% of the total, but the question of proper installation is involved, and the necessity for technical engineers who can calcuate heating requirements will be found an excellent investment, which the additional time spent in obtaining correct results will be well worth while as it will remove much friction.

COMPARISON OF VARIOUS RADIATION FORMULAS.

With a view to the presentation of some facts on the subject a comparison has been made of results from the use of Carpenter's, Mills, the N. D. H. A. short and the N. D. H. A. long rules and also of a technical method found in Harding and Willard's work on "Heating and Ventilation." The calculations made are based on a temperature difference of 70° F. between the inside and outside air, a pressure of 2 lbs. gauge, a building four floors high of rectangular shape, an occupancy for retailing merchandise, a use in which all floor space can be considered as open, radiators of the 3-col. 38-in. size, an office and sales force of 80, a gravity return system and a construction as follows:

Inside dimensions: 80 ft. x 140 ft.
Exposure: East and west (80 ft. each)
Floor and Ceiling Data:

Floor	*Height to Ceiling Feet*	*Construction*	*Temp. Deg. F.*	*Floor Area Sq. Ft.*
Basement	9	4-in. concrete on 6-in. cinder bed	None	11200
1st	15	8-in. reinforced concrete	70	11200
2nd	12	8-in. reinforced concrete	70	11200
3rd.	11	8-in. reinforced concrete	70	11200
4th	11	8-in. reinforced concrete	70	11200

Wall, Glass, Door and Space Data:

Floor	*Wall Area Sq. Ft.*	*Glass Area Sq. Ft.*	*Door Area Sq. Ft.*	*Volume Cu. Ft.*
Basement	3960	1500	100	100,800
1st	5000	1500		168,000
2nd	3980	1300		134,400
3rd	3740	1100		123,200
4th	3740	1100		123,200

Wall Material: 13-in. brick, all floors.
Glass: Single thickness.
Doors: 1½-in. pine.
Glass Exposure:
East side: 800 sq. ft., first floor.
700 sq. second floor.
600 sq. ft., third & fourth floors.
West side: Balance of area on each floor.
Door Exposure:
East side: 60 sq. ft.
West side: 40 sq. ft.

In order to enable the reader to follow the calculations an outline of the various rules used is given below:

Carpenter's rule: $H = (0.02nC + G + \frac{1}{4} W)\ (t - t_o)$

where C = Cubical contents of room in cubic feet.
n = Number of air changes per hour.
0.02 = B. T. U. to raise 1 cu. ft. of air 1° F.
W = Net wall surface in square feet.
G = Glass surface in square feet.
$t - t_o$ = Temperature difference between inside and outside.
H = Total heat supplied per hour in B. T. U.

Mill's rule:

$$R = \frac{C}{200} + \frac{W}{20} + \frac{G}{2}$$

where R = Direct steam radiating surface in square feet.
G, W and C as for Carpenter's rule.

N. D. H. A.
Short rule: $R = 0.008\ C + 0.08\ W + 0.35\ G$

where R = Required steam radiation at from 1 to 3 lbs. pressure.
G, W and C as for Carpenter's rule.
Note: No allowance for exposures of extreme nature.

Long rule: This includes the following tables:

Table 1. The B. T. U. required per degree difference between rooms and outside for various air changes.

Table 2. The heat transmission in B. T. U. per degree between rooms and outside for various types of construction.

Table 3. The percentages by which heat losses in Table 2 must be increased if exposure is other than southern.

Table 4. The coefficients of heat transmission for various types and classes of radiators.

Add. to

Table 2. The percentages by which radiation must be increased due to high ceilings.

Qualifications and limitations are given and the B. T. U. required per square foot of radiation is given for various systems as follows:

Gravity—1 to 3 lbs. pressure	250
Vapor, with radiator traps	241
Atmospheric, with open returns and excess cooling surface	200

Results of Calculations:

Rule	*Radiation Required, Sq. Ft.*	*Percent Variation*
Carpenter	8592	169
Mills	6072	119
N. D. H. A. Short	7466	145
Long (2 air chg.)	12134	238
Long (1 air chg. on upper floors)	9824	193
Harding and Willard method	5096	100

CAUSES OF VARIATIONS IN CALCULATIONS.

It will at once become apparent that the wide differences in results justifies the questions as to who is right, why the variations are so large and what has been the result from a service standpoint.

In the first place accuracy can never be secured by "cut and fit" methods and all short rules must necessarily fall into this classification simply because they cannot take into account all of the factor which affect the need for heat. These factors include the heat losses through walls, ceilings, floors, doors and windows; the temperature which must be maintained in various rooms; the lowest outside temperature which can be expected from past experience; the heights of floors; the exposure; the amount of cold air which enters the structure around or through doors and windows; the heat which is furnished by human beings or equipment; the average pressure of the steam; the coefficient or coefficients of heat transmission for the radiator installation; the insulation used; the frictional losses of the system and the equipment employed. Only that method can be correct in which all factors are based on data obtained through careful experiment. This is not true of any rule published.

COMMON CAUSE OF ERROR DUE TO ASSUMING NUMBER OF AIR CHANGES.

One of the worst causes for error in calculating radiation required is due to neglect of the air which enters the building or to an attempt to arrive at the quantity by assuming so many changes of air per hour. Without the aid of tests any assumption is a pure guess. Considerable experimental data on infiltration of air around doors and windows is available but there is a distinct need for information as to the air which enters through open doors and windows. Other common errors are the result of using a coefficient for radiators which does not fit the installation, attempting to use cubic space in calculations, neglecting the losses through floors and ceilings and failure to credit an installation with the radiation of heat from sources other than the heating system.

MORE EFFICIENT INSTALLATIONS GOOD FOR BOTH CUSTOMER AND UTILITY.

Infiltration losses may easily represent one-fifth to one-quarter of the total losses in buildings which are of good construction but which are poorly maintained. Losses from the failure to insulate can be as great. But these losses come from a false idea of economy which the consumer seldom realizes. This condition is bound to continue until the utilities who furnish steam heat adopt methods of figuring required radiation in the fixed charge on a sound basis. Then and only then will efficient installations receive credit, and uneconomical installations be penalized. At first glance this result may appear undesirable from a standpoint that it cuts down the possible income from the consumer. In the last analysis it will be found that what is good for the customer is also for the good of the utility. An example of this can be found in fire insurance where the best rates are obtained by those who reduce their hazards to a minimum.

Most of the consumers depend on the heating utility for information as to radiation which should be installed. Under conditions which duplicate the building figured it is very evident that more radiation will be installed than is actually needed. This not only means an unnecessary first cost but it also increases the possible steam consumption where thermostatic control is not had. With differences in construction, equipment and occupancy the percentage variation will change, but the data presented indicate the need for standards which are fair to all, which do not increase first cost unnecessarily, which do not discriminate in favor of certain manufacturers, which encourage consumers to install efficient equipment, which penalize those who are uneconomical and which are not weak from a legal standpoint.

WHAT ABOUT OZONE?

Details of the Recently-Completed Chicago Tests to Determine the Status of Ozone for Ventilation

BY E. VERNON HILL AND JOHN J. AEBERLY, M. E.
Of the Chicago Department of Health.

IV

IN Experiment No. 13 three tests were reported on the effects of low concentration of ozone as a bacteriacide. The concentration of ozone ranged from 2.1 parts per million to 8.3 parts. No bacteriacidal effects could be detected with these concentrations and under the other existing conditions of the test. After Experiment No. 15 was completed and the striking effect of higher concentration of ozone noted in its effects on molds, experiment No. 16 was made to see what the effects would be of higher concentrations on plate cultures of bacteria.

Experiment No. 16:

In this experiment ten sterile Petrie dishes were exposed on a table in Dr. Hill's office for ten minutes. The plates were then covered and taken to the experimental room. Five of them were placed in the ozone cabinet and five remained outside the cabinet under practically the same air conditions. The latter were used as a control. The covers of the plates in the cabinet were lifted slightly above the dish itself and small strips of wood placed under the edges of the cover in such a manner that the plates still remained covered, allowing, however, for a circulation of air beneath the cover on to the media. The plates were placed in the cabinet at 2:40 P. M. and removed at 4:00 P M. The following tabulation shows the time of exposure and the concentrations from a test made at four periods during the same:

Time.	Concentration parts per million.
2:40 P. M.	301
3:00 "	317
3:30 "	434
3:50 "	452
4:00 "	plates removed.

The development of bacteria on the plates was as follows:

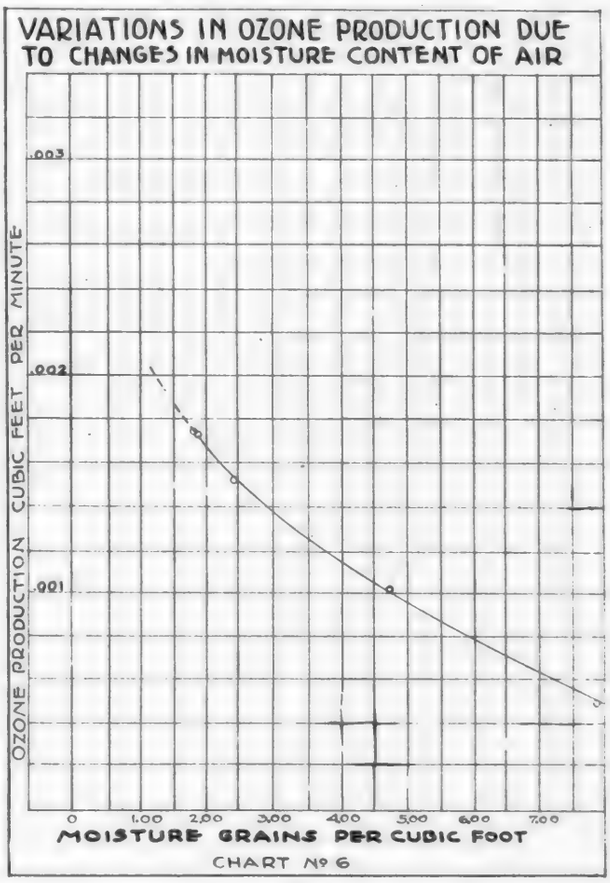
Exposed to Ozone.		Control.	
Molds.	Bacteria.	Molds.	Bacteria.
0	15	2	21
0	6	2	33
1	22	3	14
0	16	0	20
0	22	2	17
1	81	9	105

From this test it is to be inferred that with an exposure of Petrie dishes for a *short period of time*, one hour and twenty minutes, a slight bacteriacidal effect can be obtained with a concentration of ozone ranging from 300 to 450 parts per million. It is interesting to note in this test that nine molds developed on the control plates and only one on the plates exposed to ozone.

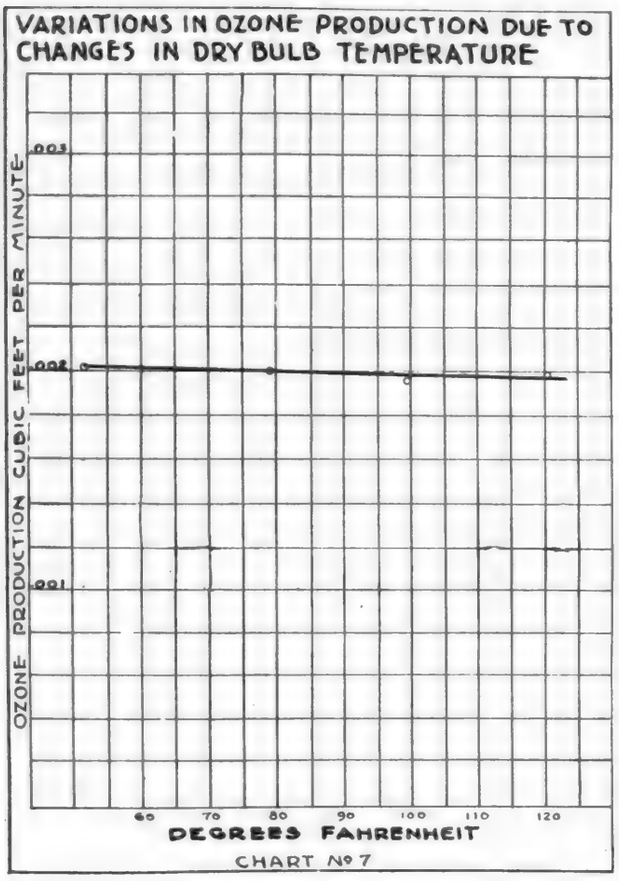
Experiment No. 19:

In view of the fact that a noticeable bacteriacidal effect was observed with a concentration ranging from 300 to 450 parts of ozone in a comparatively short period of time, the test was repeated with a higher concentration. Fifteen plates were simultaneously exposed for ten minutes in the sanitary inspectors' room in the Health Department. The plates were then covered and conveyed to the experimental room. Ten of these were placed in the ozone cabinet at 2:20 P. M. Five of these were allowed to remain until 4:00 P. M. and the other five until the following morning at 10:45 A. M. The covers of the ten plates in the cabinet were lifted by wooden strips, as in Experiment No. 16. The following is a tabulation of the results of this test:

Control Colonies.	Exposed to Ozone for 1 hr. and 40 minutes.	Exposed to Ozone for 20 hrs. and 25 minutes.
28	23	0
29	20	0
30	20	1
25	contaminated	0
Contaminated	30	0
112	93	0



In the last column the one colony noted was present when the plate was placed in the cabinet. The colony was destroyed, the entire central portion decolorizing, leaving only a thin rim on the media. The concentrations in this experiment were as follows:



Time.	Concentrations.
2:20 P. M.	275
2:30 "	—
2:45 "	334
4:00 "	283
10:30 A. M.	1015
10:45 "	1030

It should be noted in analyzing the results of this test that the five plates exposed for an hour and forty minutes were exposed to a maximum of 283 parts per million of ozone. The plates which were removed from the cabinet on the following morning, and that were all sterile, were exposed for a longer period, and also to a much higher concentration, namely a maximum of 1030 parts.

Experiments Nos. 17 *and* 18:

These two experiments are a continuation of the experiment conducted in determining ozone production under varying conditions of temperature and humidity. The results are shown in detail on the accompanying tabulation. The curves on charts Nos. 6 and 7 give a graphic illustration of the results. Chart No. 7 entitled "Variation in Ozone Production Due to Changes in Dry-Bulb Temperature" covers a range from approximately 52 to 122°. The moisture content is constant. It is evident from the curve that temperature variations, at least within the range of this experiment, have no appreciable influence on ozone production. Chart No. 6 entitled "Variations in Ozone Production Due to Changes in Moisture Content of the Air" gives an entirely different picture. The range of the experiment was from 1.81 grains of moisture per cubic foot to 7.82 grains per cubic foot. The dry-bulb temperature was practically constant during the experiment. The ozone production as shown by the curve decreased with the increase in the moisture content of the air from slightly over 0.002 cu. ft. per minute to 0.0005 cu. ft. per minute, or a decrease in production of 75%, with an increase in absolute humidity from 1.81 grains per cubic foot to 7.82 grains per cubic foot. It should be mentioned at this point that the temperature and humidity observations made were of the air entering the ozone machine and were not the actual temperatures and humidities at the spark gap. The temperature at the spark gap is very much higher than the temperatures recorded in the test, but it is reasonable to suppose that a definite and proportional ratio exists between them.

Experiment No. 20:

This experiment was conducted to determine the effect of light on ozone and also to gain some knowledge as to the stability of a mixture of air with ozone. Twenty 125 c. c. bottles with ground glass stoppers were thoroughly cleaned and dried. Each stopper was coated lightly with vaseline to make the bottle absolutely tight. All the bottles with the stoppers removed were placed in the ozone cabinet in the afternoon and allowed to remain there over night with the ozone machine in continuous operation. In the morning samples to determine the concentration were taken from the cabinet. The concentration was found to be 702 parts per million. An assistant entered the cabinet with a gas mask on, stoppered all bottles carefully and removed the same. Of the twenty bottles removed from the cabinet two were questionable and discarded. Of the remaining eighteen nine were wrapped in dark paper and placed in a hand case from which all light was excluded. The remaining nine were placed on a table near a window and subjected to direct daylight but no sunlight. It was intended to subject some of these bottles to sunlight but it happened that the weather was cloudy and no sun appeared during several successive days. The bottles were analyzed at various times over a period of three days by pouring into each bottle 20 c. c. of the starch iodide solution used in our quantitative test apparatus. The solution was shaken in the bottle and titrated with sodium thiosulphate until the blue color disappeared, exactly as in our regular determinations. The following are the tabulated results of the test:

EXPERIMENTAL DATA

EXPERIMENTERS	TEST No.	WET BULB AT INTAKE.	DRY BULB AT INTAKE	AIR VELOCITY (FT. PER MINUTE)	DRY BULB AT DISCHARGE.	AVERAGE OZONE PRODUCT CU. FT. PER MIN.	No. OF DROPS $Na_2S_2O_3$ .000080 CU. IN. PER DROP	STROKES OF PUMP	OZONE CONC. (6000 VOLTS 360 F.P.M. 70° F.)	AV. OZONE CONC. (6000 V. 360 F.P.M. 70° F.)	VOLTS	WATTS	CALCULATED VOLTAGE.
CHART No 7													
EMH JJA JD	1	58.5	52	360	66.5	.00201	23	3	126	124.5	113	112	6000
	2	59.0	52.5	352	67.0		23	3	123		115	112	6000
	3	54	80.	355	78.5	.00200	22	3	122.5	124.3	115	111	6000
	4	53	78.5	352	78		23	3	126		115	112	6000
	5	62	100.5	325	81.5	.00184	24	3	123.5	120.7	114	112	5950
	6	63.5	103	338	81.5		22	3	118.0		114	111	5950
	7	70	120	320	88	.00180	24	3	125	123.2	114.5	112	5970
	8	71	122	338	88		21	3	121.5		113.5	111	5920
CHART No 6													
EMH JJA JK.	1	62	95	300	78	.00173	24	3	113	107.5	114	112	5950
	2	62	96	296	79		22	3	102.				
	3	71	96	336	81	.00102	13	3	68.5	63.5	114	14.0	5950
	4	71	97	333	80		12	3	58.5				
	5	76	95	343	79	.00050	6	3	32.3	31.2	114	14.5	5950
	6	77	95	371	82		5	3	30.1		112.5	14.2	5870
	7	64	96	350	80	.00149	16.5	3	92.6	91.6	113.5	115	5920
	8	61.5	95	372	81	.00175	18.5	3	108.2	108.2	114	112	5950

Bottles in the dark. Concentration.	Time.	Bottles in the light. Concentration.
598	Jan. 13 11:40 A. M.	662
620	11:55 "	577
536	12:25 P. M.	536
547	1:40 "	547
567	4:00 "	555
721	Jan. 14 9:00 A. M.	688
128	Jan. 15 10:30 "	154
0	Jan. 16 9:15 "	167

The absence of a reaction for ozone in the last bottle analyzed January 16 is rather startling and raises the question as to whether or not there was leakage or some other cause that gave a negative result. This experiment needs to be repeated and varied by using a larger number of samples. It indicates, however, that ozone even exposed to the light is a much more stable substance than is generally believed.

The next installment, which will appear in the March issue, will include a discussion of the experimental data submitted, also a discussion, with some observations, of the tests in Chicago and elsewhere on the physiological effects of ozone.

CONSTRUCTION FEATURES IN THEIR BEARING ON HEAT AND FUEL ECONOMY

Typical Instances, Drawn from Wide Experience, Showing to How Great an Extent Successful Operation Depends on Good Workmanship

BY. S. HOMER WOODBRIDGE

THE molecular movement of air through the pervious material of which most walls of buildings are constructed has been in part considered in a previous paper. It has been shown that though individual molecular movement is rapid, progressive molecular movement must of necessity be slow; first, because of the high-frequency interruptions due to molecular impactings; and, second, because of the presence of fixed structural material making up the body of the wall through the minute and broken pores of which the molecules must pass,—a mass of dense and deep entanglements through which molecular travel is one of infinite embarrassment and delay, apart from purely and continuous inter-molecular interferences. Nevertheless the aggregate of such movement, even through seemingly solid and tight walls, is larger than is commonly supposed, the rates depending on the physical structure of wall material, the thickness of wall, the pressure difference —due to temperature inequalities, or to wind action, or to both, or to temperature differences alone.

Experiments made with building materials of various kinds enclosing rooms with walls and roof, that material including all grades from the porous slag, much used in Germany for low-priced building construction, to a close grained and hard-burned brick, all laid with good lime mortar binding, have demonstrated that when molecular differential movement has been due solely to low temperature difference,—all pressure difference due to wind action or any chimney-like effect of warmed and closed building being eliminated, the volume of air movement through walls and roof may equal the cubic contents of such enclosures in periods varying from approximately twenty to ninety minutes, according to the perviousness of the building material employed. The good health of the home-dwellers of many a German laborer has been officially attributed to the porosity of the slag, or other like material, of which the walls of his house are largely constructed, and through which spontaneous ventilation is so free as to overmatch the German's innate aversion to domestic fresh air.

TYPICAL INSTANCE OF PERMEABILITY OF WALLS TO MOLECULAR MOVEMENT OF AIR.

Out of the writer's numerous experiences furnishing striking proof of the permeability of walls to the molecular movement of air under slight pressure difference, one typical case may here be cited. Two 54-in. horizontal return-tubular boilers mounted in battery and in brick setting were provided with over-boiler return flues to chimney, the flues being covered in with two layers of brick laid flat and with broken joints and in the best of lime mortar. The specifications called for two coats of pure cement-wash to be applied as a filling.

The contractors failed to apply the wash. The fires failed to burn brightly, and the boilers failed to produce steam in the required quantity or at required pressure. The chimney failed to "draw." The indraft of cold air through the 126 sq. ft. of brick work flue-covering was sufficient to chill the flue gases, to reduce the "pull" of the chimney draft and to deaden the boiler fires. An application of cement-wash as specified corrected every failure. It is the writer's custom to specify cement-wash filling for the entire exposed surface of the brick settings of boilers, and it has been the prevailing custom of contractors executing work under such specifications to disregard that requirement as of importance only in the mind of the theorist.

OTHER INSTANCES

A 30-in. brick wall between certain ground floor rooms of a well-known hotel and a horse stable allowed enough stable air to pass when the hotel was warmed and closed for winter use to make the rooms unusable by guests with keen olfactory sense.

An 18-in. brick wall completely (?) separating stored high-grade butter from tropical fruit, such as lemons, oranges, etc., failed to so protect the butter against the fruit vapors as to prevent tainting and serious loss of market values.

In experimental demonstration the writer has with easy breath blown out a candle flame through a 2-in. fire brick, the area of brick surface exposure on either side being 29 sq. in.

MASS MOVEMENT OF AIR THROUGH WALLS

Air moves in current form through every avenue open to its travel under pressure action. All crevices, cracks, chinks, crannies, minute or larger apertures and pores provide such free-way avenues through which air may either trickle in imperceptible currents or pour in sensible torrents, according to the sizes of ways and the degree of the propelling pressure caused either by wind, or by the chimney action of warmed and closed buildings. The molecular movement of air through walls is one of differential molecular travel through the miscrocopic and ultra microscropic interstices provided by Nature within building material. The mass movement of air through walls is that through major or minor passage-ways provided by the builder in assembling the materials employed for and in construction work. In regard to the former, advance information may be

definite and reliable, whereas the factors regarding the latter are largely determined by the skill, the vigilance, the integrity of the architect, the contractor and the laborer.

VALIDITY OF CONTRACTS TO HEAT BUILDINGS.

It is because of the uncertainty of the value of widely variable leakage factors that only approximate exactness in computing rates of heat losses from buildings is made possible, and which makes "guarantees to heat" venturesome and unjust of requirement. The heating engineer, or the contractor, may properly be called upon to guarantee a definite thermal output, and distribution of output, from his plant. He cannot with equal propriety be required to guarantee the rate of thermal loss from any building in the designing and construction of which he has no part. It is not for him to guarantee the rate of heat loss from the owner's building. The leakage factor is one for which the engineer or contractor has no responsibility, and is one for which neither can be justly held accountable. That factor may be, and not infrequently is, the largest in the entire problem.

The writer has insistently and consistently refused to be bound by any contract involving the rate of heat loss by any building, standing ready only to pledge a definite thermal output and distribution from the equipment he proposed to furnish, thereby saving himself from undesirable experiences and clients. A large municipal school building could not be properly warmed, in most weather below 20° F. and in no weather below 10°. Tests proved the cause of failure to be in the looseness of window frames in their wall setting. When some 1½ tons of oakum had been caulked into the window frame crevices all trouble attributed to "insufficient heat" vanished.

A suburban residence of pretentious proportions and design could not be heated comfortably even in mildly cold weather. In self protection the heating contractor, under guarantee to heat the house to 70° in zero weather, employed a heating expert to examine and report on the situation. The building was found to be without sheathing boards, sheathing paper or back plaster. The clapboards were found to be warping and curling and opening.

In a Science Building, one of a considerable group, and provided with a heating system carefully designed by a recognized expert, a system purposely closely proportioned to computed theoretical needs, could not be brought to early morning comfort in colder winter weather until steam had filled the system an hour, and in the coldest weather, two hours, longer than was found necessary for the older and "rule-of-thumb" equipped building. The large building, begun in April and occupied in late September, was constructed with window frames set in place when the brick work was laid. Swollen by wet mortar, and subsequently shrunken by the drying of summer and the heat of the fall warming, the frames were loose in their setting, and leakage was free. When the many chinks were caulked the building became the easiest and quickest of all the group to bring to the wanted early morning warmth.

Because heat losses by air leakage may range from 20% to 60% of losses by transmission, computation of loss rate becomes a matter, not of precision, but of more or less gross assumption, and safety is commonly sought in a blanket method of estimate involving large and elastic factors of safety. For that reason detailed and elaborate computations employing ostensibly exact factors, though effective as a pretentious showing, may yet be farcical as to practical value.

A MEASUREMENT OF TOTAL AIR LEAKAGE.

A carefully-conducted test to determine the combined effect of molecular and mass movement of air through building material was made some years ago at the Massachusetts Institute of Technology. A room 15 ft. x 35 ft. x 15 ft. had one outside 16-in brick wall, 15 ft. x 15 ft. exposed to westward; one wall of like dimensions and construction between a main corridor and the room; one similar 15 ft. x 35 ft. wall, 16-in. average thickness separating the room from another equally-warmed room; and a 15 ft. x 35 ft. double-lathed, plastered and painted wall between the room and an adjacent enclosure of practically equal temperature. The exposed wall contained a 5 ft. x 10 ft. double-glazed window. The floor and the ceiling of the room were made of 2-in. tongued-and-grooved planking, faced with ¾-in. matched surface flooring and ½-in. matched ceiling sheathing, both floors and ceiling having water-proof paper between planking and flooring. All airways for air ingress and egress were closed, as were also the three tight-fitting doors connecting the room with adjacent enclosures and passage ways. The outside temperature ranged from 35° to 37° F. the inside from 67° to 69°. Outside weather was clear and quiet.

METHOD OF TEST AND RESULTS.

By means of carbon dioxide released from a large tank of the liquid gas, the proportion of that gas in the air of the room was raised to 100 parts, by volume, in 10,000 parts of air. The room air was thoroughly and continuously churned throughout the period of test. At 10-minute intervals four samples of the air were simultaneously taken, from different parts of the room and at different levels, for test by the Pettenkofer method, and with the following results:

RATE OF AIR CHANGE IN ROOM, AS SHOWN BY CARBON DIOXIDE TEST.

Minutes	Carbon Dioxide	Minutes	Carbon Dioxide
0	100		
10	80.8	70	24.128
20	65.44	80	20.124
30	53.15	90	18.88
40	43.32	100	14.70
50	35.456	110	12.56
60	29.16	120	10.85

The CO_2 in outside air being 4 parts in 10,000, it may be demonstrated by computation that the rate of change of air within the room closely approximated that which would result from an inflow of outside air into the room, and an escape of air from the room, in volumes, equal to the cubic contents of the room once in each 40 minutes.

PRACTICAL SIGNIFICANCE OF THE TEST.

If it be assumed, as appears reasonable, that one-quarter of the total air movement as found passed through the outside wall, and if it be further assumed that in sharply cold and windy weather, with wind blowing against the exposed wall, three times that volume of air would enter through that wall, then 6,000 cu. ft. of air per hour, or approximately an average of 26 cu. ft. per square foot of exposed wall surface per hour, becomes the normal maximum rate of leakage through a 16-in. hard-brick wall laid in cement mortar, when the glass surface, or window area, is approximately one-quarter the total exposed wall surface.

If that assumption be accepted as a conservative basis for general computation of heat loss by air leakage, then applied to a school room 25 ft. x 35 ft. x 14 ft., in which the area of the only exposed wall is 14 ft. x 35 ft., the wall containing three 5 ft. x 11 ft. windows, it appears that the volume leakage under severe weather conditions practically equals the cubic contents of the room once each hour, or somewhat in excess of 12,000 cu. ft. of air per hour. If that in-leakage be at 0° temperature, the warming of that air to 70° requires 15,500 B. T. U. per hour. The heat loss by transmission through the exposed wall in that weather is found by com-

putation to be approximately 18,000 B. T. U. That is to say, the loss by leakage approximates 46% of the total, and 86% of the transmission loss alone.

In the northern hemisphere, the northern side of buildings is least affected by solar heat, is more affected by the coldest of winds, which increase the convection rate in times of severest weather, and which also, through pressure, increase the leakage rate at times when the outside temperature is lowest Therefore, if installations for heating are made adequate to meet each and every requirement of orientation exposure of buildings, then to the north side must be given the largest factor of safety. Let the allowance for the south side, adequate for the lowest outside temperature in clear and quiet weather, be given a power capacity rated at 100, and let the initial computation for the entire building be made on that basis, a basis which includes a normal leakage factor for quiet, that is windless, weather. Then for the north exposure there must be added a quantity corresponding to the effects of sunlessness, of increased convection effects in times of strong and cold winds, and also of increased in-leakage of the coldest air at such times.

To properly compensate for those three causes of increase in the rate of heat loss through northern exposures of buildings it has been the writer's custom to multiply the per unit surface rate of heat loss as computed for the southern side by 1.35, by 1.25 for the west exposure, and by 1.15 for the east exposure, and for mixed exposures to employ factors proportional to the ratios of exposed walls.

The method of procedure in computation which has been attended by uniformly satisfactory results, has been as follows:

First, transmission losses pure and simple; second, estimated normal leakage losses in quiet weather; third, exposure corrections as above noted. The second stage is the one of largest uncertainty, the product of intelligent guess work, depending on the nature of the building, structural material, reputation of the character of the architect's work, of the contractor and his methods, of the occupant as to his dependableness in care and use of the entire equipment. The factor for the second stage, as used by the writer, is seldom made less than 1.20 and never more than 1.60; any excess over the larger value being considered so abnormal as to free the engineer of responsibility, and to impose on the owner or user an excess in operating costs of which he may properly be made aware by a demonstrated inability of the provided heating equipment to match all defects of structure.

EXTREMES IN BUILDING TYPES.

At the two extremes, in matters of heat loss, of the many types of buildings for which artificial heating is required are the canvas tent and the old-type monumental building—massive of wall without and within, with ceilings and floors made up of deeply-groined arches of solid or filled masonry, and with windows small and closely framed and set. If unheated, the tent temperatures follow those without much as a small skiff follows the rise and fall of the waves of the rolling sea on whose surface it floats, responding instantly and fully to the rise and fall of every wave encountered. Meanwhile the building of monumental type maintains an almost even internal temperature, riding smoothly over the same temperature waves as the skiff, but with only slow and slight response to the changing crests and troughs of the past rolling waves. The power and the range of the heating plant for the canvas construction must match the suddenness and the extremes of weather changes, while that provided for the massive structure may safely be planned without regard to such changes, but to the mean of such fluctuations.

EFFECT OF FREAKS OF WEATHER.

The most painstaking and correct work in computation and installation may prove inadequate to cope with such freaks of weather as occasionally surprise the inhabitants and baffle the efforts of engineers and contractors over large areas of territory. A northwest blizzard sweeping over the Great Lakes, instead of going out to sea by the habitual route of the St. Lawrence valley, will, perhaps once in a generation, break away from that route and, sweeping southward, go to sea by the Ohio and Potomac valleys, when in Washington, D. C. a temperature of —20° may for a few hours prevail. If the wind then shifts from blowing out of the northwest and blows from the southwest, a vast body of sharply cold air will be driven northward, and the incongruous phenomenon may be experienced of a —20° south wind of several hours' duration. Such a situation has once developed within the experience of the writer, when buildings in the path of the southern arctic blast were severely smitten on their least-protected flanks, and when water heating contractors and plumbers reaped an unprecedented harvest. To such exigencies, occurring but once or twice in a century, the factors of correction above recorded cannot apply. Such visitations should be so considered in the preparing of plans as to provide protection against structural damage to heating and ventilating equipments, whatever the shifting, the force or the temperature of winds.

ADDITIONAL CAUSES OF WASTE OF HEAT.

Some of the more common causes of waste in the use of heat provided for warming purposes have been noted in previous papers and paragraphs. Other causes and conditions productive of waste may be noticed as of sufficient seriousness to demand attention.

Any method of heating which overheats ceiling air in order to produce comfortable temperature at floor is wasteful. The principal economic effects of such inequality of temperature are: first, to raise the mean temperature of the building above that needed for comfort. That involves increased rate of loss by convection transfer of heat to the cooling walls, while the superheating of the ceiling and upper parts of the walls increases the rate of the transfer of heat by radiation from those surfaces to the cooling walls; second, the higher mean temperature of buildings so warmed results in a stronger chimney action, a stronger indraft of outside cold air into the lower zone, and a stronger outboard flow of warmed air from the upper zone of the building than would result if the air were of even and floor temperature; and third, the temperature of the increased volume of escaping air is that of ceiling rather than of floor air. The temperature of ceiling air in rooms 12 ft. in the clear may not infrequently be found to be from 10° to 15° higher than that of the floor air, and in rooms of 20 ft. studding that difference has in some cases exceeded 20°.

Finally, the temperature of air required in rooms for comfortable occupancy is largely affected by the part radiation is made to play in compensating heat losses from the body. The less the heat received by the body through radiation, the less the permissible heat yielded from the body by convection to the ambient air, and, therefore, the higher must be the temperature of the air of rooms and of buildings warmed by methods which ineffectively use radiant heat. Consequently, the greater must be the rate of heat loss from such buildings and rooms so warmed. On the other hand, any method of heating which employs direct radiation and which so disposes that surface as to expose large areas of outside wall to radiant action from such heat source, by so much does that arrangement contribute to heat waste.

A succeeding paper will deal with methods employable for the reduction of heat waste due to causes suggested in this and the foregoing paper.

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson No. 12—Sweeping School Buildings

BY EDWIN S. HALLETT,
Chief Engineer, St. Louis Board of Education.

THE last paper (see THE HEATING AND VENTILATING MAGAZINE for December, 1921) discussed the vacuum cleaners installed and piped up as a part of the building equipment. It is not convenient to run the pipes in old buildings and many have introduced the portable type of vacuum machine which may be moved from room to room, and the sweeping done with the same hose and tool that is used on the stationary type. This machine is of course limited to one sweeper at a time. It is apparently the only recourse that can ever be had to meet such conditions. The advantages of vacuum sweeping are so great that the small inconvenience of attaching the electric cord to a new outlet for each room should not prevent the use of the sweeper.

PORTABLE VERSUS STATIONARY SWEEPERS.

Good portable machines are on the market. All the objections seem to have been overcome except the disposal of the exhaust. The stationary machine should exhaust into the hot breeching or smoke pipe of the boiler while the portable of necessity must use the bag separation and, therefore, passes back into room the fine microscopic dust. It is this fine dust that is caught in the Hill dust counter and that which carries the odors and bacteria. Buildings not equipped with ozone take on old school room odors more quickly with the exhaust discharged into the room. If the fan system of ventilation is used and is kept in operation during the sweeping much of this fine dust will be carried off before it can settle upon the furniture.

SYSTEM IN SWEEPING.

The sweeping must be systematized as all other operations must be to make a successful janitor. It is to his interest to learn the best system. The time after school is short and very precious. The corridors and stairways may be swept before the closing bell if great care is used to keep quiet. The inlet valves often whistle upon withdrawing the hose and great care must be exercised to withdraw it quickly. The sweeping tool must be kept flat to the floor at all times to prevent noise. The vacuum sweeper may quickly lose its reputation and usefulness in the hands of a careless janitor. Silent floors are now being constructed in school buildings and their benefit must not be lost in the careless use of the sweeping apparatus. The sweeping tool is so designed as to permit great dexterity in sweeping about furniture. The swivel joint at the sweeping tool must be in perfect working order, that is, it must turn freely and without air leakage. A few lessons will suffice to teach a woman or man to sweep about the fixed pedestal desks more quickly than with a bristle broom. The rapid change to movable furniture brings new problems for the janitor. Before beginning the sweeping the movable desks should all be pushed over in solid mass against the outer wall. In some schools the teachers have the children move them over just as they leave. In others a boy will be employed by the janitor to move all of them. The clear half will be cleaned and the desks moved to the front half. The sweeping proper occupies only three or four minutes to the room. The time saved in dusting after the sweeping is a part of the economy. It is important that the instructions to the janitor be sufficiently explicit and complete that he may fully realize that the vacuum way is an advantage to him and to play his self interest up with and not against the interest of the school. Not much headway is gained in attempting to compel a man to do what he does not want to do.

THE CARE OF VACUUM SWEEPERS.

These machines run at quite high speeds and require a higher order of supervision than is required for the heating plant. The motor whether of 860 R. P. M. or 3,600 R. P. M. must be properly oiled and that means that the oil shall be high-grade motor oil and that it shall be applied at the right place and at the proper intervals. Single-phase alternators and direct-current motors have commutators and brushes which must be cleaned and kept up. It is, however, easier to secure good motor attendance than that for the machine. Get all the instructions from the manufacturer that he has and then watch and listen for anything unusual. Be sure that oil is getting through to the bearing. Put a wire through the oil hole and watch the oil disappear until it is certain that it is going in. Where grease is used the cups must be turned down a bit every time it runs and the grease must be renewed often even when there is still grease in the cup. Those who use a grease gun on the automobile will appreciate the necessity of putting force behind it. Extensive use is now made of ball bearings. If the balls are not held strictly in place and spaced equally the bearing will not run in a high speed machine. The vibration that sets up will soon ruin the remainder of it. The machines must be in perfect running balance. One drop of solder too much will put it out of balance.

A motor is sometimes taken down and reinstalled at a different position on the coupling and this throws it out of balance. To balance such a machine set it in motion and hold a sharp pointed crayon up to a machined circle on the coupling or shaft to find the direction of the throw. Then either weight the opposite side or bore out metal on the heavy side until it runs in perfect balance. This is the most important single detail of instruction necessary to be given in the case of these machines. They must run in perfect, not approximate, balance. Every machine having a shaft of some length must be balanced in place, running, that is, the marks must be made and the correction made when shut down.

The humming noise of all sweeping machines is objectionable, and for that reason the stationary machines should be placed in the basement preferably in a small room for that purpose.

It should be accessible to the boiler room as the sweepings should be burned. The machines should be mounted upon two inches of hair felt and the pipe connections to the building made with a flexible rubber section.

Questions.

1—What are the special advantages of the stationary sweeper? Of the portable machine?
2—How many vacuum sweepers improve the health of the school?
3—What are the objections to exhausting through a bag into the house?
4—What special training should a janitor receive for vacuum sweeping?
5—Can the sweeping be systematized to the advantage of the janitor?

6—What can be done to avoid noise?
7—When should the sweeping be done?
8—How long should it take to sweep a school room?
9—How should the machines be oiled? How do you clean the brushes and commutators?
10—How can a machine be kept in running balance?
11—How may a defect be detected?

BACK TO FIRST PRINCIPLES

Lesson No. 8—Humidification of Air for Breathing (Concluded)

By REID DAVIES

PHYSIOLOGICAL EFFECTS OF HUMIDITY

The effects upon human beings caused by humidity or lack of humidity in the air they breathe, may be treated from two angles, that of comfort and that of health. As a basis for this treatment it must be emphasized that air of high relative humidity prevents loss of heat by evaporation (a process of heat convection), while it aids the flow of heat by conduction (the thermal conductivity of moist air being high compared to that of dry air). The opposite effects are shown by air of low relative humidity.

From the standpoint of comfort the result of high relative humidity is to make high air temperatures seem higher, low air temperatures seem lower than they actually are. As air temperatures approach nearer that of the body, the conduction of heat from the body decreases even when the moist air favors that conduction. Should air temperatures equal to body temperature, or above it, be experienced the moist air will favor conduction of heat to the body. Under both conditions the only means for heat loss from the body is by evaporation and high relative humidity hinders that process. So the high temperatures seem higher when the air is moist. As air temperatures recede below that of the body, the tendency toward conduction of heat from the body increases. At low air temperatures this loss of heat from the body by conduction through moist air is much greater than the amount of heat which the moist air keeps in the body by preventing evaporation. So the low temperatures seem lower when the air is moist.

On the other hand the effect of low relative humidity on comfort is to make high air temperatures seem lower and low air temperatures seem higher than they actually are. At high temperatures the dry air aids dissipation of body heat by evaporation and so makes the temperatures seem lower. At low temperatures the dry air favors retention of body heat by preventing conduction and so makes the temperatures seem higher.

From the standpoint of health the question of what constitutes a proper degree of humidity, depends upon various conditions. In the first place, humidity is not generally considered independently in therapeutics, but always in connection with temperature. In the second place the combination of high temperature and high relative humidity is one which favors growth of the micro-organisms that cause many forms of disease, while it also favors the growth of the body cells whose function is the combatting of these parasites. And the opposite conditions of low temperature and low relative humidity, which tend to hinder parasite development, also serve to reduce the resistance of body cells to parasitic attack. Somewhere between these extremes lies the optimum combination for each ailment and this has to be chosen with regard to the particular needs of each disease and often with regard to the stage of the malady and the reserve strength of the invalid.

VARIETY OF AIR CONDITIONS NEEDED IN CURING DISEASE.

In cold, dry climates there is less danger of fevers, digestive and nervous ailments, and pulmonary tuberculosis can be checked and frequently cured, but these conditions favor pneumonia which is uncommon in warm, moist climates where the former diseases are particularly virulent. Bronchitis, catarrh, and rheumatism which thrive at the expense of the patient in air that is cold and damp, often yield quickly to treatment in a warm, dry climate. It must be understood that purity of the air has a large bearing in the cure of most diseases and that determination of favorable air conditions is but one part of a complete course of treatment. However-that one part is of large importance and it is easy to imagine in a general hospital of considerable size, the simultaneous need for a wide variety of conditions combining air temperature and relative humidity.

Under normal conditions of temperature and humidity and during good health, the mucous membranes of the nose form a humidifying apparatus which serves to impart to inhaled air a sufficient supply of humidity before that air reaches the pharynx on its passage to the lungs. But when the relative humidity is too low (and when the air is inhaled through the mouth) this nasal humidifier is not able to supply the required amount of evaporation. In some nasal affections there is excessive discharge of moisture and for such ailments a dry air is desirable. When there is a deficient flow of moisture, as in other nasal diseases, there is need for a damp air for breathing.

Even in the case of a normal person in good health the humidity requirements vary to some extent. When doing active work a low relative humidity aids rapid evaporation of perspiration, and so helps to more rapid dissipation of body heat. Under conditions of combined high temperature and high relative humidity, continuous active work becomes impossible, but these same conditions experienced in the taking of a vapor bath, often prove both pleasant and beneficial.

Mechanic's Lien for Heating System—Statute of Limitations.

In a bill against a realty company and its trustee in bankruptcy to enforce a material man's lien for a heating system furnished for the defendant's hotel building, wherein the Alabama six months' statute of limitations was interposed as a defense, the invoice contained these notations: "2% 10 days—30 days net—f. o. b. origin of shipment." And at another place, "Terms 2% cash and 30 da. date." The Alabama Supreme Court held, C. A. Dunham Co. v. Sheffield Realty Co., 88 So., 562, that this and other evidence sustained a finding of the trial court that the apparatus furnished was to be paid for within 30 days of its delivery, so that the claim was barred, notwithstanding that the whole account was not to fall due until a certain time within six months before commencement of suit. The mere furnishing of an extra flange for a rotary pump which was an essential part of the heating system was held not to make the contract a continuous one so as to bring it within the statute of limitations, where the price of the flange had been included in the original bill. The authorities hold that if there is a hiatus between the items sufficient to permit the filing of a lien, the presumption is that the items belong to separate contracts.

The Heating and Ventilating Magazine
A MONTHLY JOURNAL of ENGINEERING PROGRESS
Member of the Associated Business Papers Inc.
Member Audit Bureau of Circulations.

Vol. 19 February, 1922 No. 2

Published Monthly at Cooperstown, New York, by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices
1123 BROADWAY, NEW YORK
A. S. ARMAGNAC . . . . . President and Editor
GUSTAVE PETERSEN, Secretary-Treasurer and Business Manager

European Representative
W. G. HOLLINGWORTH, Bessemer House, Adelphi, London, W. C.

Subscription	$2.00 per year
Canada	2.25 per year
Foreign Countries	2.50 per year
Back numbers	25 cents each

THE recent growth in the number and character of publications issued by technical bodies brings up an interesting point as to the extent to which these publications should become commercialized in the sense of deriving their revenue through the publication of manufacturers' advertisements, also the extent to which they should enter the general technical field in the way of publishing contributed and other matter in addition to that presented at their professional meetings, and, finally, their attitude toward the technical periodicals already in the field.

Looking at the matter in a broad way, it has been the history of society publications that their success, so far from retarding the progress of the trade and technical journals in their respective fields, has been accompanied by a corresponding growth of such periodicals, the theory being that the additional efforts of the society journals help to broaden the field, as well as to enhance its importance.

As advertising mediums such organs are, to some extent, competitors of the trade and technical journals in their fields. For that reason, perhaps more than any other, it is not common to find society organs enthusiastically supported by the trade press, although there may be no desire or intention to stand in the way of their progress. We believe we express the general view when we state that, in the long run, society publications, no less than trade and technical journals themselves, must stand or fall according to their merits. If they are of real service they will live and attract the support of both reader and advertiser. If not, they may drag on their topheavy existence, with their true character known to all, but at last they must succumb. Such a test, we believe, will be applied in the future more rigidly than in the past so that in each case merit will be the deciding factor in the life of either a trade journal or society publication.

IN the general agitation for standardization of materials, processes, etc., society publications appear to have been entirely overlooked. Most of the trade periodicals, as is well known, are subscribers to an established code of ethics and it is natural to expect that a similar code will be needed sooner or later by the society press. For instance, such a code, in our judgment, could very properly contain a provision that the solicitation of advertisements should not be made directly by a member of the society or not, at least, by one who has direct business relations with the prospective advertiser. It is easy to see why such solicitation is seldom refused and why the securing of such advertisements depends on something in addition to the merits of the publications themselves. When a manufacturer can give no other reason than "What else could I do?" for inserting his advertisement in such a publication, we doubt very much whether the societies are gainers through the transaction.

MANY society journals, which at first were confined to their own proceedings, have gradually expanded so as to include in their contents contributions in the form of original papers, as well as abstracts of other papers and, in some cases, the entire text of articles published elsewhere. If this is what the members want, there may seem to be no reason why the practice should not be extended indefinitely. From another point of view, however, if such matter is available in the trade periodicals, it is likely that a better use could be found for this portion of the members' dues than to duplicate the efforts of the trade journals.

This leads naturally to a discussion of the co-operation that should exist between an association organ and the trade publications in the same field. In our opinion, their lines run, or should run, parallel. Each has a necessary function to perform and it is a matter of good judgment, as well as good policy, that their lines should cross each other as little as possible. Most trade periodicals are scrupulously careful not to trespass in any way on the scope of the society journals but, so far as we know, no professional body has set any definite limit to its participation in the general technical publishing field.

When the code of ethics for society publications comes to be written, we have no doubt the points above enumerated will find a place therein and it will be of immeasurable service to such publications because it will give them that whole-hearted support that is needed and desired by them all at the hands of the trade press.

NOW that the blanket indictment of some fifty heating firms and individuals in New York City for violating the Donnelly anti-trust law in agreeing to "fix" contract prices has been entered, all concerned may well hope that the issues raised by the Lockwood committee in its investigation of this phase of the construction industry will soon be met and settled. There is nothing to be gained in postponing the issue.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Notable Progress in all Branches of the Profession Reported at the Society's 27th Annual Convention

WITH a remarkable diversity of subjects on its program and in the attractive environment of the world's largest hotel, the 27th annual meeting of the American Society of Heating and Ventilating Engineers, at the Hotel Pennsylvania, New York, January 24-26, proved a notable event in the history of the society. While the registration was not quite as large as last year, there being 254 members and 155 guests present, as against a total registration last year in Philadelphia of 524, the attendance at the sessions fully equalled that at any previous meeting, while the discussions were full and spirited.

A realization of the important place the Research Laboratory of the society has assumed was brought home at the Wednesday afternoon Research Session when practically the entire staff of the Research Laboratory, headed by Director F. Paul Anderson, was given places near the chair and later took part in the proceedings by presenting important papers reflecting the work of the Research Laboratory on such subjects as heat transmission through building materials; temperature, humidity and air motion effects in ventilation; and a discussion of the ozone situation, with special reference to oxides of nitrogen produced by ozone apparatus.

JAY R. Mc COLL
President, American Society of Heating and Ventilating Engineers.

Opening Session, January 24.

President Champlain L. Riley called the meeting to order in the Hotel Pennsylvania at the opening session Tuesday afternoon. He introduced Secretary D. L. Gaskill of the National District Heating Association, who extended the greetings of that body. Mr. Gaskill announced that the Handbook of the district heating association, which has been eagerly awaited, is now ready for distribution and he expressed the opinion that the wealth of engineering data contained in the Handbook would be found of equal interest to both heating and ventilating engineers and central station heating engineers.

He invited the society members to attend the next convention of the National District Heating Association which, he stated, will be held at Cedar Point, O., June 21-23.

President Riley then presented his address. He spoke enthusiastically of the society's latest project, the Guide, which will be issued in March and which he predicted would be of the utmost usefulness to the profession and industry generally.

He then discussed the need of changes in the society's constitution to give better representation in the governing body and he described the organization of the American Medical Society as one which could well serve as a model. If carried out, the arrangement would separate the business and technical activities of the society into two organizations. This would also serve to permit the society to do many things which are not now permitted by its charter, such as regulating the fees of engineers.

Mr. Riley mentioned incidentally that a charter for a chapter in Denver has been applied for by the members in that section.

The report of the council was presented by Secretary Obert. This report characterized the forthcoming Guide which the society is publishing as not a side issue, but the "heart of the society."

Secretary Obert, in his report, also dwelt on the value of the Guide as proposed. He summarized the work the society now has under way in coöperation with other organizations. He reported the financial condition of the society to be greatly improved. The present net membership, he stated, is 1480, after deducting a total of 97 names which for various reasons have been dropped. He said that in the drafting of the proposed new constitution, provision would be made for affiliate membership, as well as life membership. The net cost per member for the past year was $22.32 which is still far above former costs but lower than those for the previous year.

In the auditing committee's report, with which was also incorporated the report of Treasurer Homer Addams, the total expenses for the year were shown to be $20,168 and the expenses, $19,909, leaving a balance on the year's operations of $259. This added to last year's balance, gave a total balance of over $600. In the Research Laboratory fund there is a balance of $17,000.

COMMITTEE REPORTS.

Committee reports were then taken up, commencing with the report of the Publication Committee, Perry West, chairman, which showed, among other things, a printing cost of $10,000 for the year.

An important report was presented by Stewart A. Jellett on a proposed code of ethics for engineers. In urging the adoption of the code he made the statement that 90% of the society's members are employees.

The code as proposed is one compiled by representatives of five national engineering societies, namely, the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers and the American Society of Heating and Ventilating Engineers. The heating society was represented in the preparation of the code by Frank T. Chapman, chairman; Stewart A. Jellett and Perry West.

The joint committee recommended the adoption of a short code, as given, and that a method of interpreting and administering the code be adopted by each participating society. The following procedure was recommended:

The president of each society or institute shall appoint a *Standing Committee on Professional Conduct,* to administer the Code of Ethics. The duties of such a committee shall be to interpret the code and to render opinions on any cases of questionable conduct on the part of members that may be submitted to the committee. These interpretations shall be reported to the executive board of the institute or society who may approve these interpretations, or take such other action as may seem just and necessary. The reports of the Committee on Professional Conduct when approved by the executive board, shall be printed in abstract *and in anonymous form* in the institute's or society's monthly journal for the instruction and guidance of fellow members.

This Committee on Professional Conduct shall be appointed in each institute or society by the president holding office at the time of the adoption of this code and shall consist of five members, one appointed for five years, one for four years, a third for three years, a fourth for two years and a fifth member for one year only. Thereafter, the president then holding office shall appoint one member annually to serve for five years, and shall also fill any vacancies that may occur for the unexpired term of the member who has withdrawn. These appointments shall be made from among the older members of the institute or society, so that advantage may be taken of their mature experience and judgment. The committee after appointment shall elect its own chairman and secretary. The committee shall have power to secure evidence or other information in any particular case not only from the organization's own members, but if it should seem desirable, from men in other professions. The committee may also appoint sub-committees to consider certain cases when deemed necessary.

This committee shall investigate all complaints submitted to it by the secretary of the institute or society bearing upon the professional conduct of any member and after the member involved has been given a fair opportunity to be heard, the committee shall report its findings to the executive board of the institute or society. This report may in some cases suggest certain procedure of the executive board.

The executive board of the institute or society shall have power to act on the recommndation of the Committee on Professional Conduct, either (1) to censure by ltter the conduct of the member who has acted contrary to the code, if the breach is of a minor character, or (2) to cause the member's name to be stricken from the roll of the institute or society.

Copies of all reports made by a Committee on Professional Conduct to the executive board of each institute or society shall be furnished to each other Committee on Professional Conduct administering the code. This will keep each committee advised of the interpretations of other committees, and in time an extended interpretation of the code can be written based on the reports of the various Committees on Professional Conduct.

As interpretations of the various Committees on Professional Conduct administering this code may vary at times, it is recommended that the chairmen of these committees of the various institutions or societies be authorized to act as a joint committee to review such differing interpretations and to bring them into unity with one another.

The code was signed by the Joint Committee on Code of Ethics, the representatives of the A. S. H. & V. E. being Frank T. Chapman, Stewart A. Jellet and Perry West.

Following is the code itself.

A Code of Ethics for Engineers.

Engineering work has become an increasingly important factor in the progress of civilization and in the welfare of the community. The engineering profession is held responsible for the planning, construction and operation of such work and is entitled to the position and authority which will enable it to discharge this responsibility and to render effective service to humanity.

That the dignity of their chosen profession may be maintained, it is the duty of all engineers to conduct themselves according to the principles of the following code of ethics:

1. The engineer will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country and devotion to high ideals of courtesy and personal honor.

2. He will refrain from associating himself with or allowing the use of his name by an enterprise of questionable character.

3. He will advertise only in a dignified manner being careful to avoid misleading statements.

4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.

5. He will inform a client or employer of any business connections, interests or affiliations which might influence his judgment or impair the disinterested quality of his services.

6. He will refrain from using any improper or questionable methods of soliciting professional work and will decline to pay or to accept commissions for securing such work.

7. He will accept compensation, financial or otherwise, for a particular service, from one source only, except with the full knowledge and consent of all interested parties.

8. He will not use unfair means to win professional advancement or to injure the chances of another engineer to secure and hold employment.

9. He will coöperate in upbuilding the engineering profession by exchanging general information and experience with his fellow engineers and students of engineering and also by contributing to work of engineering societies, schools of applied science and the technical press.

10. He will interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind.

The report was warmly received and was unanimously adopted by the society. F. R. Still, in supporting the report, declared that the society ought to go further and make it a condition that all society members should sign the code, while applicants for membership should be called upon to subscribe to the code in applying for membership.

It was voted to continue the committee to put the code into effect.

William G. R. Braemer reported for the Committee on Legislation.

For the committee on Memorial to J. R. Allen, Professor Samuel E. Dibble reported that a total subscription of $311 had been received. With these funds a bronze tablet has been purchased and placed in the corridor of the Experimental Station of the Bureau of Mines in Pittsburgh, where the society's Research Laboratory is located. The tablet was unveiled on October 27. Professor Dibble recommended that a balance

which the committee has on hand be devoted to providing prizes for the best papers presented to the society on heating and ventilation. This matter was turned over to the incoming council.

For the committee on Revision of Constitution, James A. Donnelly brought out a number of legal points which showed the need of an entire revision of the society's constitution.

For the committee on Industrial Reconstruction Frank T. Chapman, chairman, called attention to the work of the American Federated Engineering Societies, especially the publication of their report, in book form, on "Waste in Building Construction." On motion of Mr. Chapman, the society voted to approve the work of the A. F. E. S. and pledged itself to join the organization "when financially able."

For the committee on Model Chimney Ordinance, P. J. Dougherty, chairman, told of the promulgation of the Model Chimney Code by the National Board of Fire Underwriters, and stated that the committee would formally recommend the adoption of the code by the society. While the committee withheld its approval of the chimney sizes recommended in the code, he stated that he personally favored the sizes given as being an improvement over the present situation, as strictly speaking there is no engineering basis for the practice now followed in both low and high-pressure work.

Director F. Paul Anderson of the Research Laboratory reported for the Committee on Standard Method for Testing Fans that the work had just started. It is expected that a form of code will be ready for presentation to the society at its next meeting. At present, he said, the disc fan is the principal bone of contention.

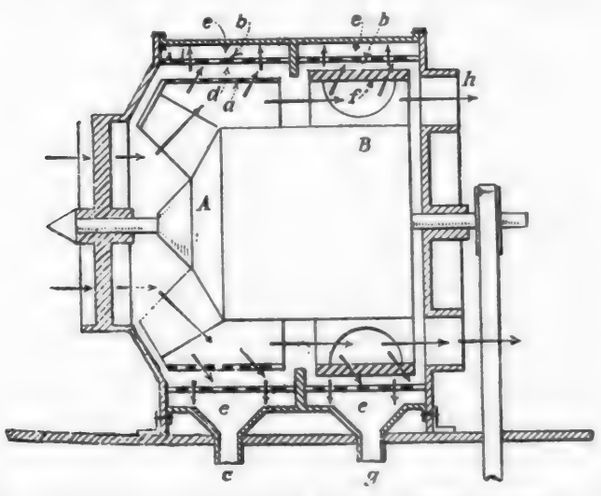
For the Committee on Synthetic Air Chart Willis H. Carrier, chairman, stated that the Research Laboratory was engaged in making experiments with the chart and would probably have some suggestions to make at the next meeting.

Under new business the matter of the use of the society's emblem on members' business stationery was taken up. This was declared to be distinctly unethical and that members should confine themselves to the use of the phrase "Member, American Society of Heating and Ventilating Engineers" and that other grades of members, such as associates and juniors, should use corresponding titles on their stationery.

NEW OFFICERS.

At the conclusion of the session the report of the tellers was presented showing the election of the following officers:

President, Jay R. McColl, Detroit, Mich.; first vice-president, H. P. Gant, Philadelphia; second vice-president, Samuel E. Dibble, Pittsburgh; treasurer, Homer Addams. Council: Joseph A. Cutler, William H. Driscoll, E. S. Hallett, L. A. Harding, E. E. McNair, H. J. Mayer, Champlain L. Riley and Perry West. Committee on Research: H. M. Hart, J. D. Hoffman, J. I. Lyle, W. S. Timmis and Perry West.



THE BALDWIN FAN-SEPARATOR FOR WASHING, DRYING AND CONDITIONING AIR.

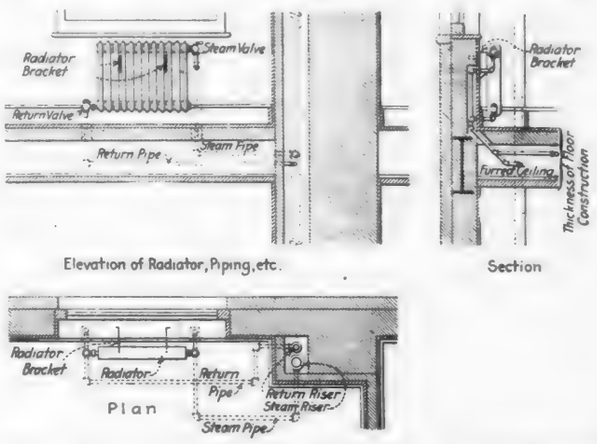
Evening Session, January 24.

The evening session was opened with the presentation of a paper by William J. Baldwin on "Improvements in the Process for Cleaning and Drying Air Mechanically." This paper was presented by Mr. Baldwin's granddaughter, Mrs. C. Richmond DeBevois, and described an improvement in the design of the type of fan characterized by Mr. Baldwin as an aero-hydro-fan-separator, which was first described in a paper read before the Society in 1917.

A paper was then presented by Arthur K. Ohmes on "Heating, Ventilating and Mechanical Equipment of the Hotel Pennsylvania.

Heating, Ventilating and Mechanical Equipment of the Hotel Pennsylvania in New York City.

Mr. Ohmes, for the most part, touched only on the high spots in the description of the installation in this building, for which



TYPICAL ARRANGEMENT OF RADIATORS IN GUEST ROOMS AND PIPING CONNECTIONS.

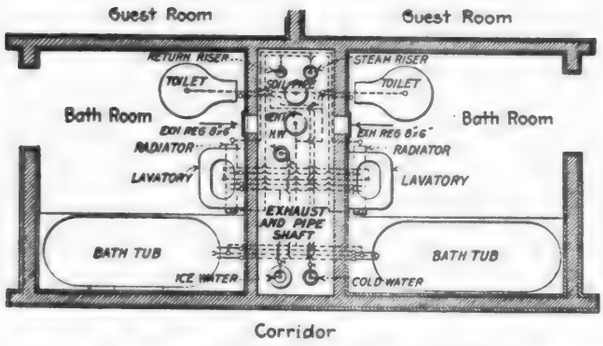
his firm were the consulting engineers. Among the statistics mentioned were the following:

The hotel, which is the largest in the world, has 2,200 rooms, occupying an area of about two acres, with cubical contents of 18,000,000 cu. ft., and a height of 27 stories, three of them below the street. Among its record breaking figures are the following: a dining room 142 ft. x 58 ft.; a plumbing pipe system of 111 miles; 26 elevators; ice and refrigeration plant of 195 tons; daily use in cooking of more than 50,000 cu. ft. of gas; laundry, washing and ironing daily more than 20 tons of table and bed linen alone; the world's largest private telephone exchange, with about 3000 stations in the house and 70 operators to handle the 24 hour volume of calls, which totals in a month, besides the incoming interphone and long-distance calls; more than 10,000 outgoing city calls.

The number of guests averages 2800 to 3000 a day, with 2250 employees to serve them.

The hotel building is heated with a low-pressure-steam vacuum-return-line system, the return lines being kept under a vacuum between 5 and 10 in. The steam pumps are of ample capacity and the automatic return valves are of sufficient tightness to easily maintain the higher vacuum. Ordinarily, the steam is carried at atmospheric pressure, but it is raised slightly during the cold weather and it is less in warm weather. In other words, a vacuum is maintained even in the steam lines.

Of special interest is the arrangement of the radiators, piping, etc., of the guest rooms. Note that the radiators are hung on brackets; that all pipe connections come through the wall instead of through the floor, making possible the uninterrupted laying of carpets and easy vacuum sweeping below them. All

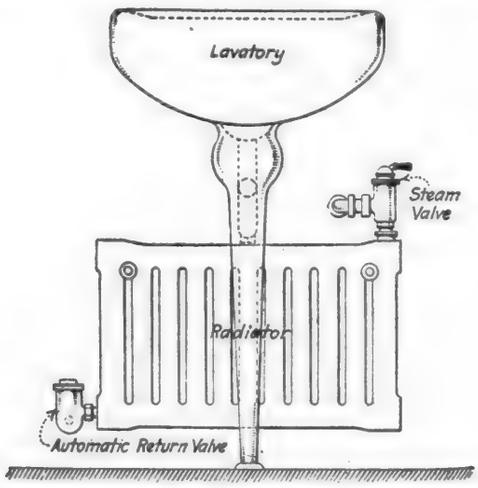


COMBINED EXHAUST AIR AND PIPE SHAFT, SHOWING PIPING CONNECTIONS TO BATHROOMS.

guest-room radiators have been provided with fractional valves for hand control, but all public rooms have automatic temperature regulation.

All bathrooms are heated, whether inside or outside, and generally these radiators are arranged as shown in the accompanying illustration. The entire building has almost 5000 radiators, with a total heating surface of about 110,000 sq. ft.

Mr. Ohmes also gave a general idea of the ventilating equipment, stating that there are literally thousands of air inlets and outlets provided. For that reason mention was only made of the ventilation of the interior bathrooms. The vertical shafts act not only as shafts for the pipe systems, but also as exhaust shafts for the bathrooms themselves. In the top story, these shafts are connected by galvanized iron ducts to the respective exhausters. He said it was necessary to give careful considera-



ARRANGEMENT OF RADIATORS IN INTERIOR BATHROOMS.

tion to the arrangement of the piping in the shaft, as well as the proper connection and size of the individual register entering the shafts, as otherwise an uneven air distribution would result. It is necessary to operate the exhaust fans on these systems at all times to prevent the reversing of the circulation in the upper bathrooms.

Both steam and electric current are supplied from outside sources, the steam coming from the adjoining central heating station of the Pennsylvania Railroad through a main of some 1600 ft., under about 140 lbs. pressure. There is, however, a steam dynamo installed partly for emergency use, if the outside service should be interrupted.

The paper also discussed briefly the other features of the equipment, including the 65-ton ammonia compressors for the refrigerating plant, the plumbing which includes a high-pressure system for the upper floors, the compressed air and pneumatic systems, the 24 elevators and the vacuum cleaning system.

Mr. Ohmes estimated that the plant as installed was saving $19,600 a year over the cost of steam and electricity had been furnished by a public service corporation in New York City. This estimate was based on a steam cost of $1.00 per 1000 lbs., and an electric current cost of 3.1 cents per kilowatt-hour.

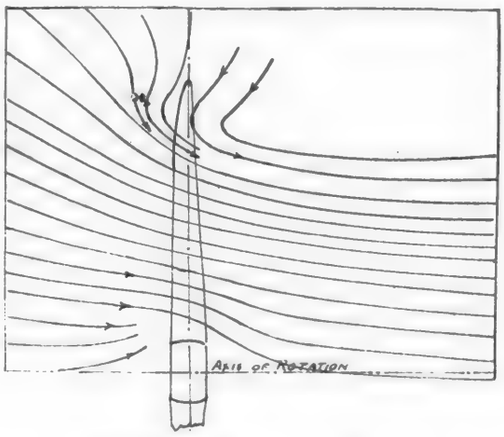
Following the presentation by Mr. Ohmes the members were taken in a body to inspect the mechanical equipment of the hotel in operation. This proved a feature of much interest and was participated in by a large number. Mr. Ohmes, the consulting engineer for this installation, accompanied the party and explained in details various points regarding the equipment.

Morning Session, January 25.

A topic on "Effect of Wind on Heating of Buildings" which was left over from the previous session, was presented by W. L. Fleisher. Mr. Fleisher stressed the point that greater precision was needed in connection with the factors of inleakage and exposure which we now term the wind variable. We will always need a factor of safety, he said, but as it is, the common factors used all have a decided wind allowance.

E. S. Hallett proposed a standard window construction so that heat losses around and through windows would be expressed by a single constant.

Stewart A. Jellett said that infiltration depends on the character of the wall surface and instanced the case of a building



FLOW OF AIR THROUGH DISC FAN (PAPER OF E. N. FALES)

in Atlantic City where the infiltration through the walls was actually greater than that through the windows. Other speakers brought up the same point.

H. M. Hart said that in some sections the north wind is not always the coldest although north exposures are generally accorded the largest percentage above the estimated requirements. In his locality (Chicago) the peak loads come with southwest winds, although they are not of long duration.

W. H. Carrier said that it was his practice in heating industrial buildings to figure 50% of the radiation losses as the allowance for infiltration. In a recent case however, of a brick industrial building this resulted in the overheating of the building and when the machinery was in operation no heat from the system was needed at all. He emphasized the fact that the building was of especially tight construction.

The first paper on the session's program was on "Standardized Method of Measuring Fan Delivery," by E. N. Fales. This paper described a method of testing cooling fans, as well as the larger type of propeller fans where the flow is not enclosed. Mr. Fales had some interesting things to say in connection with an analysis of air flow through these fans, showing, for instance, how the blast assumes the form of a spiral, being enclosed in a dynamic shell which corresponds, in a way, to a real duct. This fan blast, he said, has a fairly definite boundary, even though unconfined by ducts. He also said that in analyzing the spiral and accelerated flow of the blast, its cross-section was found to be a minimum, 0.75 diameter, and its velocity maximum at about

0.5 diameter downstream of the blades. Here, he said, is the proper place to take the measurements. A suitable instrument for the purpose consists of a miniature Pitot-venturi tube, such as is used on aircraft, giving a pressure reading 1½ times the Pitot tube alone. The manometer for reading these pressures, of the Krell type, is one familiar in wind-tunnel work.

The flow from a fan of this type, said Mr. Fales, is much more complex than is popularly supposed. The fan takes in air axially from the rear, radially from the sides, and even, slightly, from the front at the tips. Acceleration is very rapid, from practically zero a few inches away, to maximum at about 0.5 diam. downstream of the blades; the inflow acceleration is about one-third that of the outflow. The boundary of the flow contracts in proportion as acceleration exists; until at the minimum section acceleration is complete, and atmospheric pressure obtains in the blast thenceforth it decelerates and spreads out at atmospheric pressure.

Emphasis must be laid on the fact that the blast converges as it leaves the blades, contrary to the popular conception. Beyond the minimum section it does diverge, but very slightly. The erroneous idea that the blast is divergent as it leaves the blades is attributable to the large volume of entrained air which surrounds the main blast. Of this there is a greater and greater amount downstream, acquiring from the blast such energy as does not go into heat by internal friction. Aside from the small secondary flow of entrained air, the outflow blast (near the fan) is as definite and clearly defined as a jet from a garden hose.

"The Importance of Pure Water Supply in Humidifying Systems" by Fred F. Bahnson and Leona Maloney was presented by Mr. Bahnson. This paper considered the probable effects of the use of impure water in the different types of air moistening apparatus now in use. Air washing, he said, is the only washing process we know in which the same water is used over and and over with mere straining through wire mesh or perforated metal screen.

The dirt found in the ordinary washer tank is evidence that the air has been relieved of that much of its dirt content, but how many people would patronize a laundry using water as dirty as that found in almost any recirculating water tank of apparatus which is supposed to wash the air we breathe; and who would care to eat in a hotel where the table ware was washed in the air washer tank? Perhaps one reason for our complacency is the fact that it is harder to detect the effect of dirty water on air than on linen and table ware, and yet we heartily agree with the statement by a recent writer that "avoidable pollution of air is as much a crime as the intentional pollution of a well or stream from which people have to secure their water supply."

Mr. Bahnson then took up the five general types of apparatus used in which humidification is the chief and practically the only object sought. These were designated as (1) absorbent surface humidifiers, (2) atomizers, (3) spray head, (4) fan type and high-duty heads, and (5) centrifugal humidifiers.

The speaker made the point that drops of water from the ordinary types of air washer are forcibly distributed in fine particles. This, he said, gives particular interest to the results of bacteria tests on water used in humidifiers. These results are given in the accompanying table.

TABLE 1. RESULTS OF BACTERIA TESTS ON WATER USED IN HUMIDIFIERS.

Humidifier	Source of Sample	Average number of Bacteria per cc.
Type 3	Fresh Water Supply	100
Type 3	Recirculated Water	18,000
Type 5	Fresh Water Supply	100
Type 5	Waste Water	15,000

NOTE: Samples of 0.1 cc. were used in tests, which were made on agar plates incubated for 48 hours at 37.5 deg. cent. As a result of many tests on these machines, we may assume the following:

1. In type 5 there are at least 100 bacteria per cc. being freed through this machine into the air.

2. In type 5 the waste water contains 14,900 more bacteria per cc. than the number in the fresh supply.

3. In type 3 the supply water and waste are no longer distinct in recirculation, having been in contact by passing through the same tank.

Tests have shown, said Mr. Bahnson, that bacteria are carried 50 ft. on minute particles of water, as well as on dust particles and he questioned the possibility of any air washer's fulfilling the specifications to remove 98% of the microscopic dust.

W. H. Carrier said that air has an oxidizing effect on bacteria and he doubted whether air passing through recirculated water in an air washer would have more bacteria than outdoor air.

E. S. Hallett said he thought we should get away from the term "recirculated air" and use the term "repurified air" instead.

A paper on "Ozone in the St. Louis Schools," was presented by E. S. Hallett.

Ozone in the St. Louis Schools.

Mr. Hallett devoted his paper to a discussion of the results which have been observed in the St. Louis schools since the introduction of ozone in the air supply. Regarding the irritating effects which are sometimes mentioned, he stated that all the observations made seem to point to the fact that ozone is not an irritant to the mucous membrane itself, but the active oxidizing power of ozone attacks the secretions lying on the surface and imbedded within the open structure of the membrane and this byproduct produces some irritation and the forcible removal of the secretion may have a physical straining or rupturing effect on the tissues of the membrane. The reason for this belief, he stated, lies in the fact that the irritations, where present at all, subside within a few days with the high concentration still maintained. Another evidence is taken from the similarity of ozone to hydrogen peroxide which attacks the secretions and extraneous matter, but does not affect living tissues. For this reason he felt that experiments should be extended over a long period.

Regarding the effect of the use of ozone on the coal bill, Mr. Hallett stated that the records of the St. Louis schools show that in the year 1916 there were 115 standard school buildings beside 123 other special and portable buildings and the total coal consumed was 36,400 tons. By 1919 the regular grade schools had increased by nine and one large high school was built and the coal consumption was 32,062 tons. In 1920 the number of large buildings had grown to 128 and the coal consumption for the year was 28,572 tons. Considering the increase of buildings and using present coal prices the economy in 1920 over 1916 is about $40,000 per year.

Recirculation with ozone has been installed in fifteen old grade schools, three new grade schools and two old high schools containing approximately 25,000 persons.

F. R. Still quoted a statement by Dr. Benjamin Moore before the National Institute for Medical Research, of England, to the effect that what we call ozone is now found to be nitrogen peroxide.

Mr. Hallett said this point had been considered in the care of the ozone machines used in the St. Louis schools and it had been definitely ascertained that these machines were not producing nitrogen peroxide. In connection with a statement regarding the accumulation of carbon dioxide in air-recirculating systems, Mr. Hallett stated that the accumulations occurring in ordinary practice could never be of great moment as we have long since learned that carbon dioxide in itself is not particularly

harmful. He said it was his practice in St. Louis to recirculate as much as 85% of the air, especially in new schools.

E. Vernon Hill discussed the tests recently made by him in Chicago and stated that the time had not yet come for the society to take a decided stand one way or the other on ozone. He thought we should wait until confirming observations had been made of those already obtained.

Mr. Lohman of the Ozone Purifier Co., of Chicago, gave some interesting data on the use of ozone in preserving stored eggs, as well as the health of poultry stock.

Research Session, January 25.

Wednesday afternoon was featured as a Research Session and included reports of the Committee on Research, followed by papers by the staff of the society's Research Laboratory, preceded by the address of Director F. Paul Anderson.

In reading the report of the Research Committee, J. R. McColl, chairman, presented the following program of work in which the bureau is now engaged. He said a drive for further subscriptions for the support of the Bureau would be inaugurated in the Spring:

Radiant Heat Loss from Steam Radiators.
Heat Losses from Pipes Buried in the Ground.
Circulation of Water in Hot-Water Systems.
Heat Losses through various Building Materials.
Electrical Method of Testing Radiators.
Infiltration through various forms of Building Construction.
Relation between Outside Wall Temperatures and Dew-Point.
Standardization of Dust Measurements.
Checking Application of Heating Boiler Testing Code.
Standardization of Pipe Sizes.
Study of Combustion in Domestic Heating Boilers.
Economy of Burning Mixed Gases.
Heat Loss through Glass.
Chimney Investigations.
Economy of the Gas Grate.
Transfer of Heat from Steam to Liquids of Various Densities.
Temperature and Humidity Effects on Health.
Ventilation Problems.
Industrial Dust Elimination.
Velocities Necessary to Move Materials.
Wet-Bulb Temperatures most Effective in Dehydration Problems.
Effect of Use of Ozonators.
Minimum Volume of Air for ample Ventilation.
Correct Method of Air Distribution for most Effective Results.

Director Anderson spoke under the topic of "Current Research in Heating and Ventilating." The heating engineers' society, he said, is the first of the national engineering societies to establish and maintain a laboratory of research. He said the function of the bureau, as he saw it was (1) to determine basic laws, (2) to stimulate research work at other institutions and (3) to act as a clearing house on physical facts relating to heating and ventilation. He believed much more can be done than at present in enlisting the interest and coöperation of other institutions, such as the colleges and universities. In one recent instance an invitation to some twenty universities to take up a given investigation brought favorable responses from seventeen of them.

In addition to the work now being done, Director Anderson stated that Professor Samuel E. Dibble is about to make a survey on chimney construction to be used by the Research Laboratory as a starting point for an investigation of the subject. Director Anderson said we might eventually come to the point where we would produce draft electrically. We would then be able to make the draft to fit the boiler and make ourselves independent of chimney heights and sizes.

The meeting then had the pleasure of hearing from members of the staff of the Research Laboratory through a series of papers covering subjects that have been taken up by the bureau. These included the fellowing:

"A Study in Heat Transmission with Special Reference to Building Materials," by F. C. Houghton.

"Temperature, Humidity and Air Motion Effects in Ventilation," by O. W. Armspach and Margaret Ingels.

"Oxides of Nitrogen Produced by Ozone Apparatus," by G. W. Jones, W. P. Yant, and O. W. Armspach.

In addition a notable paper was presented by Professor W. K. Lewis of the Massachusetts Institute of Technology on "Heat Transfer for Conduction and Convection," in which he laid emphasis on the importance of taking into consideration the three-fold character of thermal resistance and dealing with each separately. He said the important points to be kept in mind are, first, that mass velocity, viscosity and thermal conductivity are the major factors in determining the coefficient of heat transfer from gases or liquids to solids, and second, that, for accuracy, heat transfers must be calculated by the use of film coefficients, one for each side of the heating surface.

Formulas were included for figuring heat transfer on this basis.

Morning Session, January 26.

At the opening of the Thursday morning session a report was presented of the Committee on Chapter Relations which stated that the Chapters would be asked to devote one meeting during the coming year to a given subject and the proceedings of each meeting sent to headquarters. This, it is hoped, will give a valuable symposium on the subject selected, which will probably be "Central heating systems vs. isolated plants."

A paper on "The Control of Blower Motors," was presented by Henry G. Issertell. This paper discussed the conditions involved in the control of motors and described a recent development in motor control by which a reduction in speed is secured without loss of power.

Other papers presented at this session were on "Dehydrating and Freshening of Codfish," by Henry W. Banks, 3d, and on "The Underfeed Stoker," by Frank A. De Boos, Mr. De Boos's address was accompanied by lantern slides, showing the development of the underfeed stoker from its inception.

Final Session, January 26.

The final session was featured as a heating session, the opening paper being one on "Heating the Average Home Economically," by P. J. Dougherty. Mr. Dougherty's talk was devoted to boiler design and operation. He pointed out that in considering the economical operation of a new plant or how to improve that of an old one, there are nine principal factors or conditions that must be coördinated, any one of which may cause unsatisfactory results. The owner of the house, he said, is responsible for four of these conditions, the heating contractor for three of them and the heater manufacturer for two of them.

The owner, he said, is responsible for and should furnish a properly-constructed building, with ample draft, suitable fuel and intelligent operation of the heating plant. A strong draft, properly controlled, declared the speaker, is the best fuel economizer on the market.

Faulty chimneys are responsible for more heating troubles than any other condition. A highly efficient heater will prove a failure on a poor draft. A chimney less than 35 ft. high is erratic and uncertain in its action, and usually gives trouble in rainy or snowy weather. A tile 12 in. x 12 in. is the best size for the average house. No tile less than 8 in. x 12 in. should be used. A 4-in. tight brick partition should separate all tile lined flues in a chimney. All heater flues should be subjected to a smoke test and made tight before being accepted. Leaky flues are the most frequent cause of draft troubles. No other

connection should be made to the heater flue but that of the heater.

Both heater and piping, he said, should be covered with asbestos, or better still, boiler cement.

The heating contractor and engineer, said the speaker, are responsible for the proper capacity and proper construction of the heating plant and the type of heater used. Most of the heating boilers, he said, in the average homes are too small. It is the general practice to install boilers on only an 8-hour firing basis, instead of on the 10 or 12-hour rating basis.

Finally, the heater manufacturer, said Mr. Dougherty, is responsible for the proper rating and design of the heater. The boiler testing code of the A. S. H. & V. E., he declared, sounded the death knell to the old swivel chair methods of rating boilers. The two formulas set forth in the original code for boiler capacity and boiler rating, he said, marked the real beginning of establishing a uniform standard for the commercial rating of low-pressure boilers. He thought it was unfortunate that later revisions of the code merged both of these formulas into one. Mr. Daugherty advocated a revision of the code, so that it would set forth the proper distinctions between hard-coal ratings and soft-coal capacities.

In concluding he urged the society to establish proper standards and define the various responsibilities for economical house heating, these standards to be enforced by the Heating and Piping Contractors' National Association.

In additional comments, Mr. Dougherty explained the difference between the terms "rating" and "capacity." The rating of a boiler, he said, is the number of pounds of steam developed in a given number of hours, while its capacity is the number of pounds of steam that may be developed in an hour.

In discussing causes of heat losses from buildings, one speaker made the point that the loss of heat through the roof shingles is a more important item than the inleakage of cold through the walls and windows and he cited the way snow on the average roof will melt.

The final paper of the meeting was then presented, being entitled, "Tests of Humidity Conditions in a Residence Heated by a Warm-Air Furnace Using Recirculated Air," by A. P. Krantz.

Tests of Humidity Conditions in a Residence Heated by a Warm-Air Furnace Using Recirculated Air.

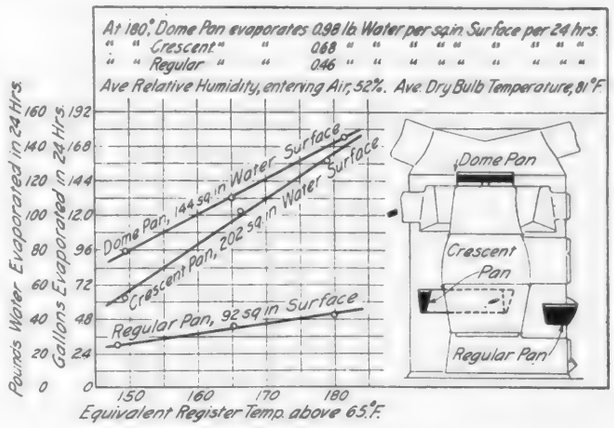
In this paper A. P. Kratz, research professor of the Department of Mechanical Engineering, University of Illinois, gives the results of some humidity tests carried out at the university's experiment station. Although the investigation is not yet completed, it was felt that enough data had been obtained to issue a preliminary report. In the tests reported three different types of water pans were used and the evaporation rate obtained from each for various rates of combustion. An effort was also made to determine the effect of the location of the pan upon the evaporation rate.

The first pan used was the regular cast-iron pan furnished by the makes of the furnace and was located in the front casting just below the feed neck for the coal. This pan had a total evaporating surface of 92 sq. in., 60% of which extended through the front into the space between the firepot and the front casting. The second pan was a shallow cylindrical pan placed on the dome of the furnace. The bottom of the pan was held about 2 in. above the dome by three small legs.

The third pan was crescent-shaped, with a wedge-like cross-section. It was placed just inside the casing and extended practically all the way around the firepot, a gap being left for the feed neck. The object in using a pan of this shape was to intercept part of the heat radiated from the firepot, as well as to increase the effective evaporating surface over that of the other two types of pans. For the tests this pan had an evaporating surface of 202 sq. in., which, however, was later increased to 267 sq. in. The water in the feed neck of the pan was separated from the water in the pan by a bridge and hence the feed neck was not considered as effective evaporating surface. In a third test the total evaporating surface was increased to 304 sq. in. when the water level stood 1 in. from the top edge of the pan. In all the tests a constant water level was maintained in the pans.

In the first evaporating test, run in the laboratory, it was found that the pan on the dome was the most effective as a humidifier, the crescent-shaped pan coming next and the small pan of standard type, last.

In the tests of the crescent-shaped pan, it was found that they are much more effective with high register temperatures and led the investigators to the conclusion that the evaporation was dependent upon the radiation received from the firepot.


At 180° Dome Pan evaporates 0.98 lb. Water per sq.in. Surface per 24 hrs.
" " Crescent " " 0.68 " " " " " " " " "
" " Regular " " 0.46 " " " " " " " " "
Ave. Relative Humidity, entering Air, 52%. Ave. Dry Bulb Temperature, 81°F.
Pounds Water Evaporated in 24 Hrs.
Gallons Evaporated in 24 Hrs.
160 192
140 168
120 144
100 120
80 96
60 72
40 48
20 24
0 0
Dome Pan, 144 sq. in. Water Surface
Crescent Pan, 202 sq. in. Water Surface
Regular Pan, 92 sq. in. Surface
150 160 170 180
Equivalent Register Temp. above 65°F.
Dome Pan
Crescent Pan
Regular Pan

RESULTS OF EVAPORATIVE TESTS ON WATER PANS.

One curious fact observed in the tests was that the register temperatures showed a marked decrease after the installation of the water pans. In one case the mean register temperature before the installation was 177° F. and 147.5° F. afterward. At the same time the mean temperature difference between air at the breathing line and outside air was 44.9° F. before installing the pan and 46° afterward. That is, it required register temperatures averaging 29.5° less in order to give a range in temperature 1° greater. This is attributed to the higher specific heat of the water vapor in the air, which enabled the weight of air circulated to carry the same amount of heat at a lower mean temperature. This is considered significant in view of the fact that from the standpoint of comfort it is desirable to introduce the air for heating at as low a temperature as is consistent with the maintenance of proper temperature at the breathing line.

As far as the effect of increased humidity on coal consumption is concerned, there seemed to be no marked change after the installation of the water pan.

On the whole, it was felt that the crescent-shaped pan is not very effective in increasing the relative humidity.

William J. Baldwin presented some calculations showing the cost of evaporating the water necessary to properly humidify a house. He showed that 50% of the fuel would be required to humidify the air in cold weather. He then asked what should be the proper humidity to maintain in residences in winter.

F. R. Still declared that this cost might be true if the same indoor temperatures were maintained. With the increased humidity, however, he said it was a fact that the same comfort could be had with a much lower room temperature, and that this difference fully balanced the additional cost of furnishing the increased humidity. He felt we should get away from the practice of judging conditions by the dry-bulb thermometer and should talk wet-bulb temperatures. We know, he said.

that 54° wet-bulb is the ideal and we should attempt to maintain that condition.

P. J. Dougherty brought up the point that with water pans placed on the domes of heaters, a leak or a crack in the pan might ruin the furnace. He therefore advocated placing the pan on a level with the fire-pot. Another objection to placing the pan on the dome was its effect in restricting both the flow of air and in lessening the heating effect of the dome.

It was brought out by Mr. Still that such water pans would necessarily get extremely dirty unless some means were provided for cleaning or flushing them. As ordinarily designed, he said, they are not easily accessible.

James A. Donnelly reported for the Committee on Steam and Return Main Sizes. He said that tests are now in progress at the Research Laboratory and at the Polytechnic Institute in Brooklyn and suggested that a meeting of the New York Chapter be held at the Polytechnic Institute to inspect these tests. William J. Baldwin suggested that engineers be invited to submit their practice in figuring pipe sizes. President Riley expressed his approval of this idea and stated that a number of engineers had sent in such data.

The newly-elected officers were installed, Fred R. Still and Frank K. Chew acting as a committee to escort them to the chair. President McColl, in taking office, asked for the full coöperation of the membership and pledged his best efforts in the work of the coming year. Responses were also made by First Vice-President H. P. Gant and Treasurer Homer Addams.

Before adjournment, resolutions of condolence were adopted expressing the sympathy of the society in the deaths of Mrs. L. A. Harding of Buffalo and Edward S. Berry, of Philadelphia.

The meeting then adjourned.

New York Chapter Acts as Host in Carrying Out Entertainment Program

Under the leadership of J. E. Bolling, chairman, the entertainment committee, representing the New York Chapter of the society, carried out a well-arranged program which included tea parties, dances, theatre parties and automobile rides.

On the opening day some forty ladies were entertained at tea in the Hotel Pennsylvania. This function was followed, the same evening, by a reception-dance in the hotel.

The next afternoon, Wednesday, was devoted to theatre parties and in the evening the society's annual dinner-dance was held in the large ballroom of the Hotel Pennsylvania. The arrangements for the dance were in direct charge of Robert W. Pryor, Jr., and from the time the toy baloons were introduced until the paper-hatted dancers were flitting to and fro in the subdued colored lights which were played upon them, the event was pronounced a brilliant success. No formal speeches were made, except that President Riley took advantage of the occasion to introduce the new president, Jay R. McColl, who was given a rousing "hand" as he rose to respond.

The final day of the meeting, Thursday, was taken up with a sight-seeing tour in motor buses provided by the Royal Blue line, one party going uptown to Grant's Tomb and the other passing through the downtown district to the aquarium.

The full entertainment committee was made up of J. E. Bolling, chairman; A. S. Armagnac, W. H. Carrier, G. A. Dornheim, W. L. Durand (chairman finance committee); W. L. Fleisher, A. K. Ohmes, W. J. Olvany, Frank K. Chew (chairman acquaintance committee); Robert W. Pryor (chairman dinner committee); Budd K. Strader (chairman information committee); and William H. Driscoll (chairman ladies' committee).

DINNER OF AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, HOTEL PENNSYLVANIA, JANUARY 25.
(West End of Banquet Hall).

SERVICE DEPARTMENT

Proportioning Aspirating Coils in Vent Flues.

In further reply to the inquiry published in the December, 1921, issue, for a formula for proportioning aspirating radiators, and calling attention to the requirements in Indiana, a correspondent states that while the Indiana requirements are 27 sq. ft. per stack, this was an estimate made from general practice in that territory. It is also general practice in Indiana to place a greater number of square feet in the stacks venting the second stories than in the first.

"We also find considerable contention," continues our correspondent, "as to how these aspirating coils should be installed. Some use column radiators, laying them diagonally across the area of the flue; others use column radiation set at the bottom of the flue, and still others use wall radiation extended up along the inside wall of the flue, with the bottom of the coils placed at least 6 in. above the top of the opening in the flue.

"Our practice in regard to this matter has been more or less arbitrary, and we vary the amount according to the size of the flue, the amount of air to be handled and the height of the stack. We do not believe that any certain rule can be set down as we find that even where a large amount of heating surface is installed there is an occasional back-draft in the stack, although ventilators of a positive-pull type are installed, which leads us to believe in many cases that the stack would be just as efficient without the aspirating coil as with it."—C. H. HAGEDON, Weinshank & Fenstermaker.

Locating Fan Blast Unit Heaters.

QUESTION: Can you give me any directions in connection with the location of unit heaters of the fan blast type?

ANSWER: It is pretty hard to give any general rules on this subject and about the only thing that can be said is that in the average building we attempt to get a more or less symmetrical spacing of the units—J. M. FRANK, Ilg Electric Ventilating Co.

Taking Care of Expansion in Risers in Tall Office Buildings.

QUESTION: I should like information on methods of taking care of expansion in risers in very tall office buildings. The particular problem which I have in mind is a 15-story office building having flat slab concrete floor construction, so that it would be difficult to conceal the pipes in the floors. I should like a little general information as to the methods used in the skyscraper buildings in New York.

ANSWER: The sole purpose in taking care of expansion in risers is not to protect the riser itself but to keep the movement of radiator branches, etc., within proper limits so that they will not become trapped or broken. The number and location of the expansion joints, therefore, are determined by the length, arrangement and location of these branches.

The most flexible and free-moving branch would be the one in which the riser and the branch would be exposed and where the branch was only supplying one radiator. The least flexible and, therefore, the most difficult to take care of would be the one where the riser and radiator branches were concealed and where the branch feeds more than one radiator.

Where the risers and branches are exposed and the branches are 4 ft. or more in length, a riser may expand through six stories, not exceeding a total of 90 ft., without any further provision for expansion than the proper arrangement of the radiator branches and the use of three elbows and a valve. If the radiator branches are concealed, however, this distance must be reduced to four stories, or not more than 60 ft.

The placing of an anchor in the center of a riser doubles the allowable distance as it permits of expansion upward and downward from the center but in every case branches must be installed with due regard to the direction in which the expansion takes place.

In the case in question, the building exceeds the limits mentioned above; therefore, special provision must be made to take care of the riser expansion. This is usually done by the use of an expansion loop, made up of pipe and fittings, or an expansion joint, of the slip or corrugated type.

We prefer to use the loop, as we have found where it has been properly installed it has required no attention. Its appearance is so ugly, however, that it can be used only where conditions permit of its being concealed by furring or otherwise.

We have used asbestos-packed slip-type joints where it was impossible to install loops and have had very good results with them. They must be carefully installed, however, and be repacked occasionally.

The loop may extend at right angles to the wall or parallel to it. It should have not less than six elbows and be about 6 ft. long and should be firmly anchored at the furthest point from the riser.

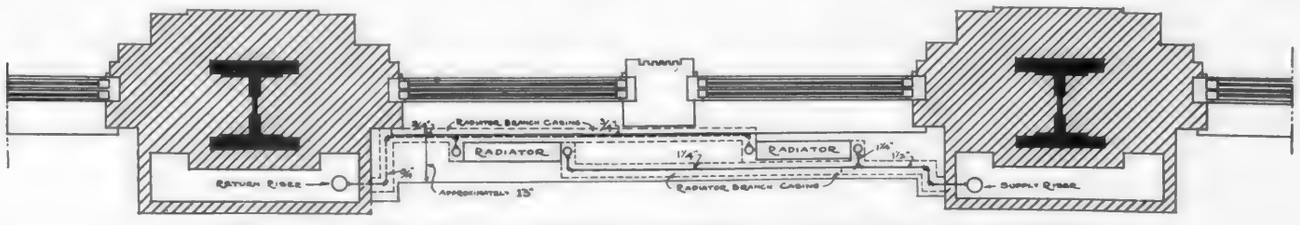
The accompanying illustrations show a number of typical methods of providing for expansion.

The correspondent states that the building has flat-floor construction so that it would be difficult to conceal the pipes in the floor. It is a good thing that this is the case as the writer has never considered it good practice from an engineering standpoint to conceal the piping although, in many buildings, it is absolutely necessary to do this from a renting standpoint.—WILLIAM H. DRISCOLL, Thompson-Starrett Co.

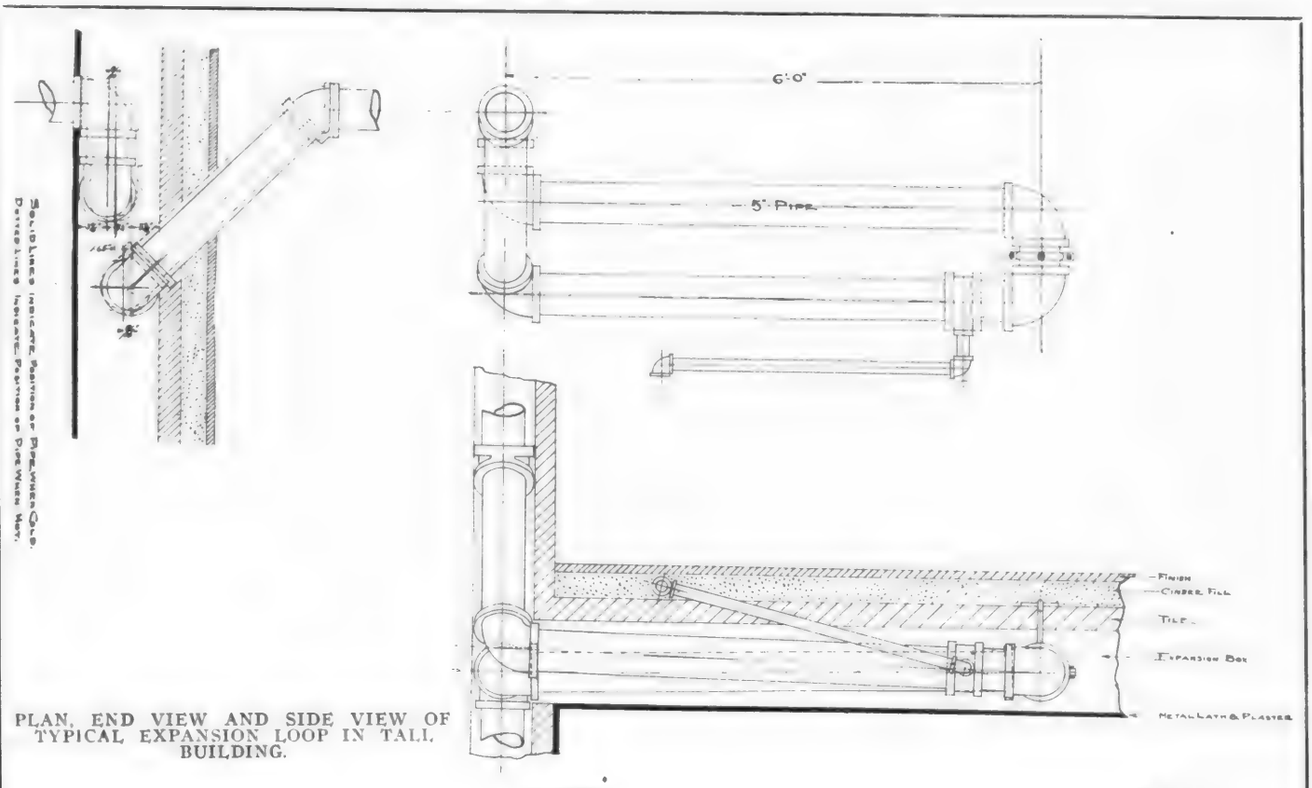
Progress of Electric Heating.

QUESTION: Will you kindly publish a review of the progress made in heating buildings by electricity?

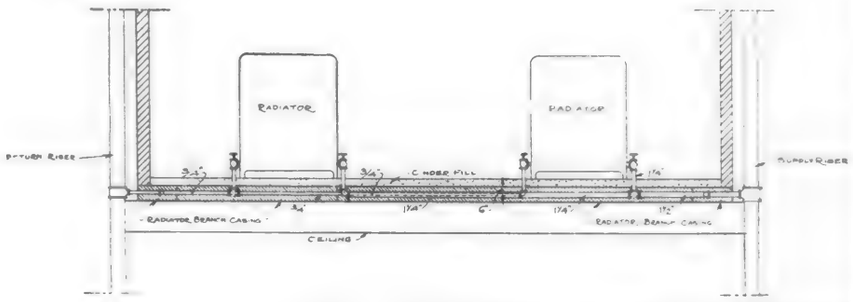
ANSWER: This inquiry can best be answered, perhaps, by stating that little or no progress has been made recently in this



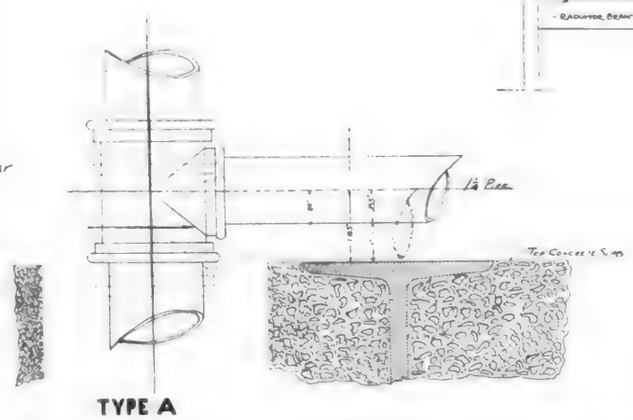
TYPICAL ARRANGEMENT OF RADIATOR BRANCHES TO TAKE CARE OF EXPANSION.



PLAN, END VIEW AND SIDE VIEW OF TYPICAL EXPANSION LOOP IN TALL BUILDING.

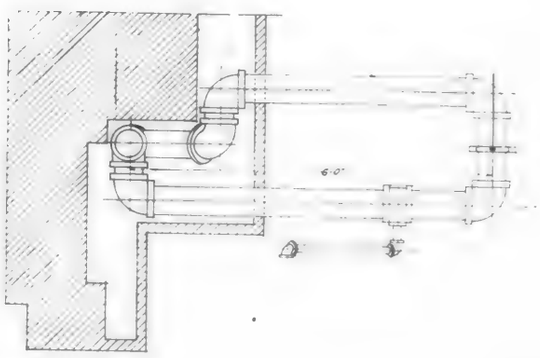


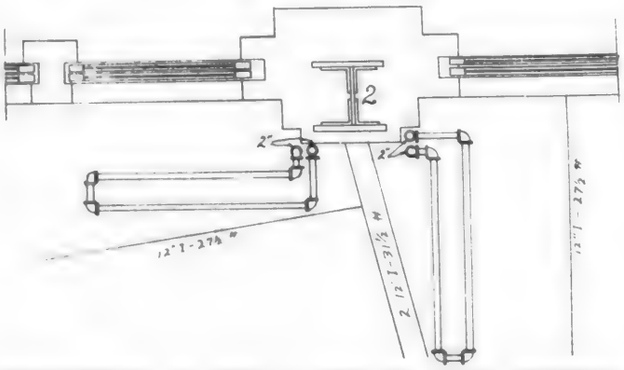
TYPICAL ARRANGEMENT OF RADIATOR BRANCHES (ELEVATION).



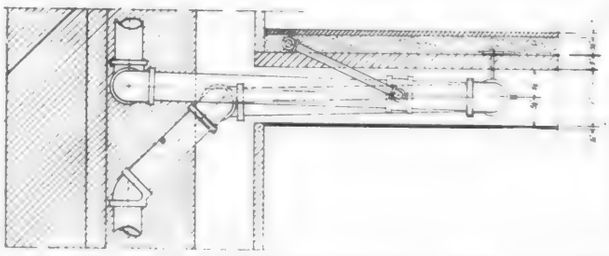
TYPE A

LOCATION OF RISER TO PROVIDE FOR DOWNWARD EXPANSION OF RISER.

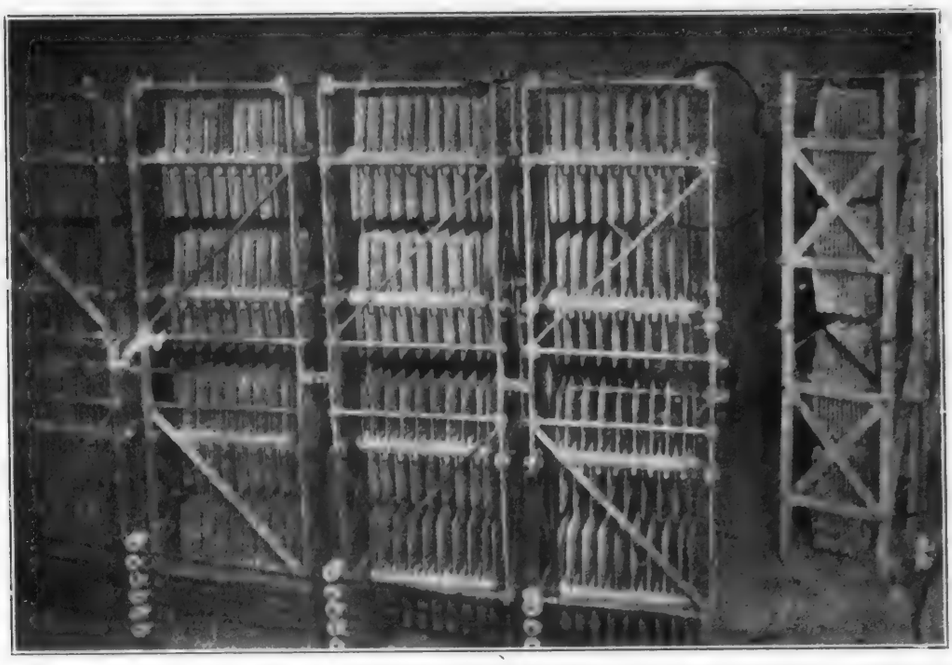




ARRANGEMENT OF TYPICAL LOOPS TO AVOID INTERFERENCE WITH STEEL.



PLAN AND ELEVATION OF EXPANSION LOOP TO MEET SPECIAL STRUCTURAL CONDITIONS.



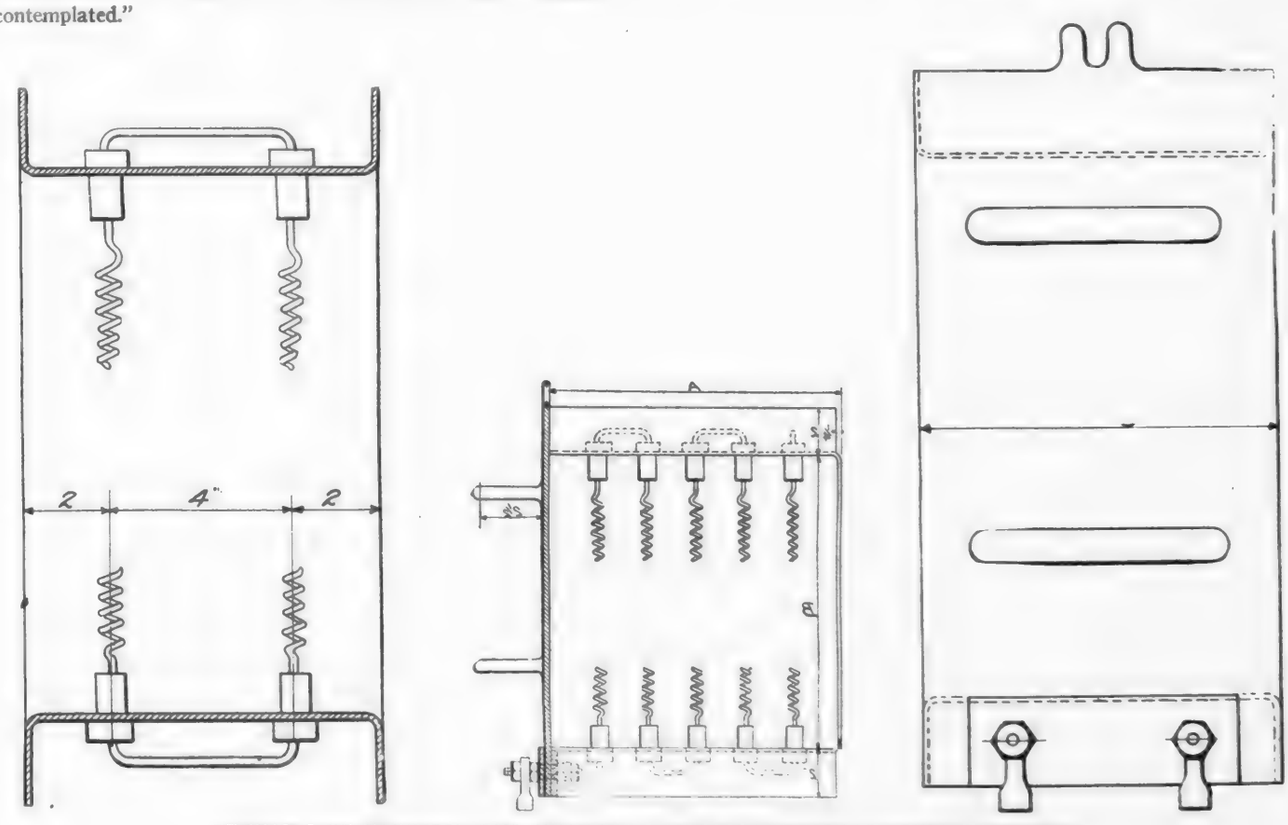
HEATER ROOM, RUPERT HIGH SCHOOL, SHOWING TEN OF THE EIGHTEEN SIMPLEX ELECTRIC HEATER UNITS.

The system, as described in THE HEATING AND VENTILATING MAGAZINE for May, 1914, uses current from the Government power house at Minidoka Dam, 14 miles above Rupert on the Snake River. The electric heating apparatus, which is arranged for use in connection with a fan-blast heating system, is composed of 18 units, ten of which are shown in the accompanying illustration. They have a total capacity of 400 K. W. These units are connected in pairs vertically each pair being under the control of a separate switch on the switchboard in the principal's office. Each pair can be switched onto a 220-volt circuit or to a 440-volt circuit, thus giving 9 or 36 K. W. for that pair. By this arrangement, any degree of temperature in the rooms may be maintained. At the time of the installation the electric current was sold at $1.00 per kilowatt per month, for heat, flat rate.

direction, except in cases where usual conditions prevail bringing the cost of electric current down to a reasonable figure. In Rupert, Idaho, for instance, there is a high-school building heating entirely by electricity. This system was installed in 1914 by the Rupert Electric Company and a recent letter from the company states that "the installation is still in operation and is in perfect condition. No modifications have been made and the expense of upkeep has been practically nothing. Owing to a very heavy increase in the electric rate since the City of Rupert took over the distribution system, the cost of operation of this plant runs high, but we do not know that a change is contemplated."

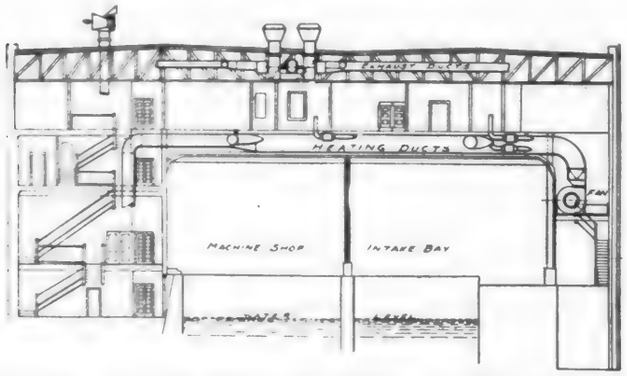
Another noteworthy installation was made in 1915 in the plant of the Hydraulic Power Company at Niagara Falls where the office building was heated throughout by electricity. In this case the type of electric coil uses is shown in Fig. 2. The coils are placed in the air ducts near their exits. The occupant of each office may obtain any temperature he desires by pressing a button switch in the wall which switches on or off one or more sections of the coils. In addition a sectional electric coil heater is located in the air intake to temper the air.

The experimental work done in Seattle, Wash., by J. D. Ross, superintendent of the Lighting Department, should also



DETAILS OF ELECTRIC COIL HEATER, PLANT OF HYDRAULIC POWER COMPANY.

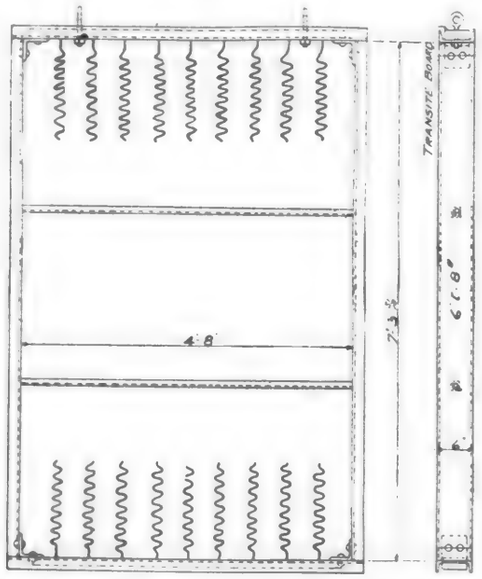
be mentioned. Here several houses were fitted up with electric heaters, both of the direct radiation type and the type used in connection with water radiators. It was learned from experience that with a water heating system 1 K. W. of heater capacity will supply 20 sq. ft. of radiation and will require 20 gal. of storage tank capacity to supply heat during the lighting peak in winter.



SECTIONAL ELEVATION OF OFFICE BUILDING OF HYDRAULIC POWER COMPANY, SHOWING ARRANGEMENT OF AIR PIPING.

It will be observed that with the above factor of 20 sq. ft. per kilowatt and 200 gal. storage per kilowatt, the remainder of the heating system may be figured as an ordinary water heating system. The direct-radiation type was found to be impracticable on account of the fact that it was necessary to cut off the current during the hours of the lighting peak.

While on the subject it may be worth while to note the data on electric heating presented before The American Society of Heating and Ventilating Engineers by William S. Hammond, Jr., vice-president of the Consolidated Car Heating Company.



DETAIL OF SECTIONAL ELECTRIC COIL HEATER IN THE AIR INTAKE, HYDRAULIC POWER COMPANY.

"The fixed relation between electric energy and heat," he said, "makes it easy to determine the amount of electric energy which is equivalent to a unit of heat. Careful tests have determined upon 1047 watts as equivalent to 1 B. T. U. or 1 lb. degree F. Therefore, it becomes an easy matter to determine the exact amount of heat which is produced in electric heaters when the consumption of current is known.

For example, if we find the number of watts, by multiplying the number of amperes passing through the heater by the difference in voltage of the heater terminals, and then divide the number of watts by 1047, we will have for a quotient the number of B. T. U. of heat generated in the electric heater per second. If we consider the electric heaters in a car to be using as a maximum 12 amperes of current on a 500-volt circuit, we will find that 12 amperes of current, multiplied by 500, will give us 6000 watts. Dividing 6000 watts by 1047, we obtain 5.73 B. T. U. of heat generated in a car per second. Muliplying 5.73 B. T. U. by 60 will give us 343.8 B. T. U. per minute. This is equivalent to 20,628 B. T. U. per hour; or, since 1 B. T. U. is the amount necessary to raise 1 lb. of water 1° F., the heat generated per hour would be equivalent to the raising of 20,628 lbs. of water 1° F.

Editorial Department,
Heating and Ventilating Magazine,
1123 Broadway, New York.

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CHATS WITH UNCLE BEN

A Heating Job with a Dry-Wet Return.

"Uncle Ben," said I, "I have a letter from a friend up in Maine who sends this sketch of his heating plant, wanting to know what's the matter with it. He says it won't work. He says he wants me to tell him some sort of pump or other outfit which he can hook on to it to make it work."

"What does your friend from Maine say is the evidence that the job doesn't work?" asked Uncle Ben.

"He says 'some of the radiators fill with air and condensed steam' and adds that 'we get but little heat from these radiators, and to heat them, which requires about 5 lbs. of steam, it overheats the other parts of the buildings.'"

"Well," said Uncle Ben, "he's none too generous with his information. He might have told the size of the steam pipe, the size of the boiler, the length of the runs, and a lot of other dope."

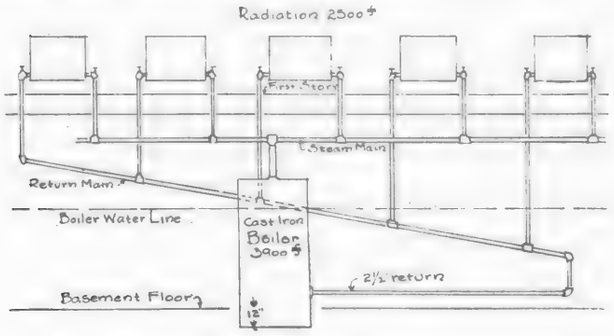
"I suppose, of course, at a glance, you can suggest to me what is the matter with the plant. I had been thinking about it. I noted that the radiation was marked 2,500 sq. ft., with a 3,900 ft. boiler; not bad, depending, of course, on who made the boiler, which was of cast-iron and likely to be given an exaggerated rating. The return was marked 2½ in. which was, according to my tables, ample for 2,500 sq. ft. The system apparently was intended for a gravity steam circulation plant with a wet return, using automatic air valves on the radiators. No information was given as to how the ends of the mains were drained, or as to the direction of pitch for the steam mains.

Timidly I said to Uncle Ben, who seemed the least bit impatient. "It looks to me like a job for a woman, where intuition and not given facts will have to be drawn on."

"Intuition, shucks," exclaimed the old man; "look at that return pipe. Are they trying to put over a job of steam fitting by the local undertaker? Oh, my boy, my boy! A dry return

or a wet return, but never, never a dry wet return or a wet dry return!

"If this job had the return well below the water line all the way around, so that each radiator or drainpoint was sealed off properly against every other point—then we'd have at least a little something to start on toward a decent job. Then if the boiler would burn enough coal and the pipes were big enough



THE DRY-WET RETURN THAT WOULD NOT WORK.

and there was enough radiation and they had good air valves, we might hope for results.

"But with this poisonous—neither fish, flesh nor fowl—half-hearted sort of a betwixt and between return, *nothing* could work and we haven't any foundation.

"If the deleted thing was all dry, with some sort of a gadget on the boiler end of the dry return to let out air and not let any air in, and this dry return was a couple of feet or so above the water line, it could still work and be a foundation for us. But as it is, it is hopeless. When the day is cold and the fire is intense and the pressure of steam is high, maybe only one radiator or two will holler—because the pressure drop due to friction in the system and condensation in the radiators causes the water in return to seal off most of the pipes.

"The less pressure there is, however, the more pipes will be dry at their junction with the return, and the more trouble there is bound to be.

"You tell your friend to drop that return so it's good and wet all the way round, put some honest air valves and then write again."

Mechanical Ventilation Again Under Fire.

As near a sensation as can easily be experienced in technical matters was furnished by Dr. W. A. Evans, writing in the *Chicago Tribune* recently when he stated:

"The severest arraignment of the prevailing methods of school ventilation which I have ever read is that which George T. Palmer has just run as a series of articles in the *Journal of Laboratory and Clinical Medicine*. The articles were based on studies of the sickness rates of school children during the winter season in several New York City schools. Some of the schools were ventilated by open windows and some by the mechanical devices in general use in school buildings.

"He writes: 'There appears to be something inherent in the indirect method of ventilating schoolrooms by means of forced draft and gravity exhaust, as practiced in this study, that is productive of respiratory affections. Something which is not present in rooms ventilated with windows and gravity exhaust.

"A part of the harm done Palmer attributes to the high temperature of the air and another part to the uniformity of temperature and of the flow of air.

"He tells us that the temperature of window-ventilated schoolrooms may be reduced to 59° without increasing the prevalence of colds.

"However, he admits that window ventilation is not entirely satisfactory, though it is more nearly so than mechanical ventilation.

"When we spend one-fiftieth the thought planning and devising that we have spent on mechanical ventilation he predicts window ventilation methods for schools that will be as satisfactory as indoor conditions can ever be made.

"For assemblies, theaters, and such larger rooms and more numerous crowds he sees no escape from mechanical ventilation.

"In window ventilation there should be ample exhaust outlets and pipes. These should be located on inside walls and with proper regard for the location of windows as well as their size.

"The radiators should be placed beneath the windows. Every window and other inlet should be provided with a deflector. If a teacher will maintain the temperature of the air in the schoolroom somewhere between 64° and 70°, changing the air constantly but without strong drafts, it matters little what any other standards are met. However, the air should be kept reasonably clean, and sunlight should be given a chance to sterilize things.

"In his judgment, the conditions of the weather are more important in causing colds than is the ventilation of the schoolroom."

In view of the foregoing comments, more than the usual amount of interest was felt in looking over this study which has now been reprinted in pamphlet form by the C. V. Mosby Co., 508 North Grand Ave., St. Louis, Mo., and sells for 50 cents. The original article is an abridged form of a dissertation presented in partial fulfillment of the requirements for the degree of Doctor of Public Health at the University of Michigan, 1920 (Dr. Palmer is now epidemiologist of the Detroit Department of Health). The study, however, on which the dissertation is based is the one which Dr. S. Josephine Baker, chief of the Bureau of Child Hygiene of the New York City Department of Health, made in 1916-1917, jointly with the New York State Commission on Ventilation.

Some 20 weeks were spent in observing the health of 5500 New York City School children in twelve different school buildings with various types of ventilation, as follows:

A—Cold, open-window rooms, gravity exhaust.

B—Cool, window-ventilated rooms, gravity exhaust.

C—Plenum, fan-ventilated rooms with gravity exhaust and with windows closed.

C—Plenum, fan-ventilated rooms with gravity exhaust and with windows closed.

As an index of health, the sickness records of the pupils were used. The usual data were taken, with the exception of the carbon dioxide content of the air. This item was omitted because the Ventilation Commission, it is stated, had already established that the carbon dioxide content of fan-ventilated rooms averages several parts lower than that of window-ventilated rooms.

The net results, as summarized by Dr. Palmer, are that:

1. Respiratory sickness is no greater in a window-ventilated schoolroom kept around 59° than it is in a room where the temperature is 64°.

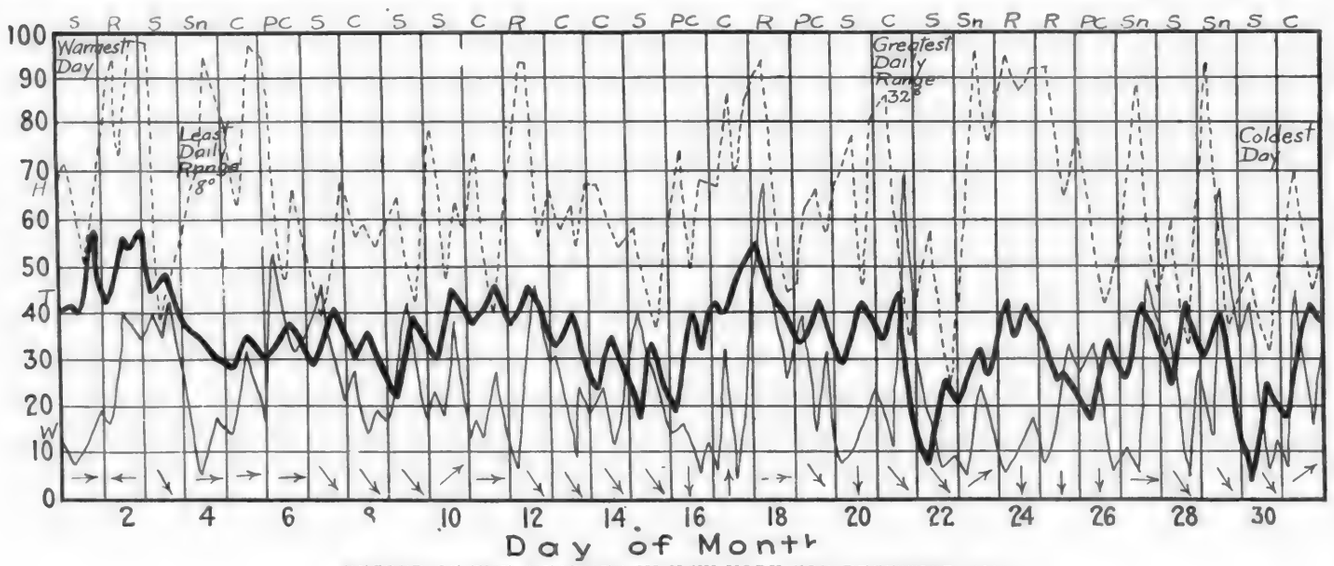
2. Respiratory sickness is greater in fan-ventilated rooms such as are represented in this study, than in window-ventilated rooms, even though there is not more than a degree difference in temperature, and the fan rooms are more spacious.

3. It is low temperature, rather than chemical purity of the air which conveys the sensation of freshness.

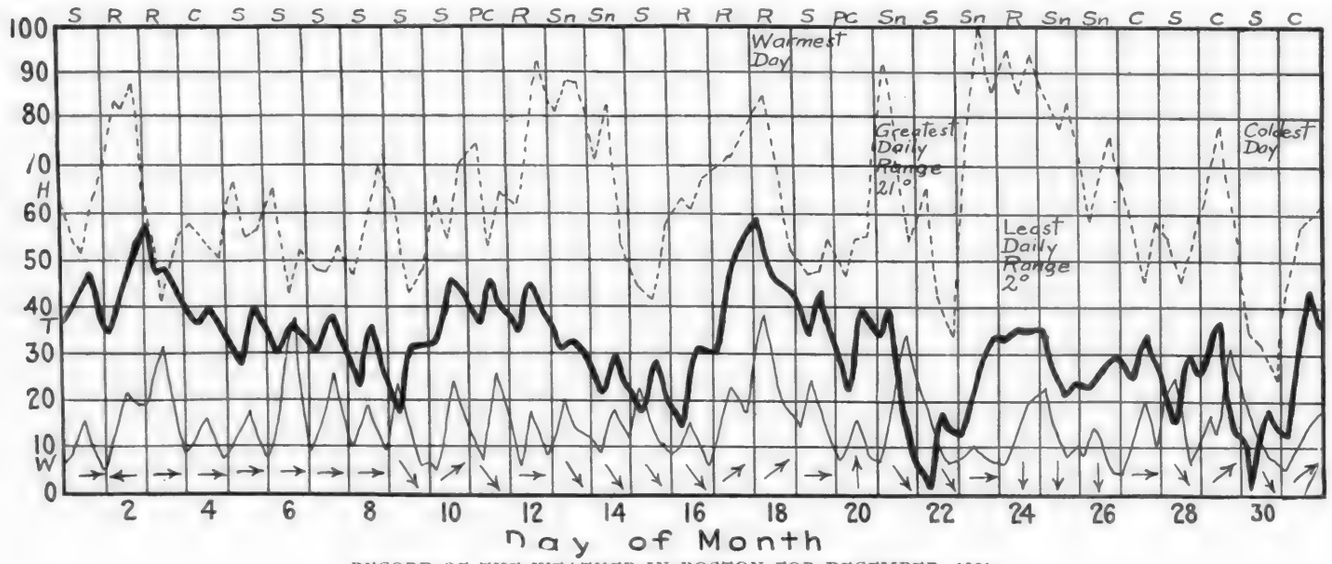
One or two points about the investigation should be mentioned. The selection of the schools, for instance, it is stated, was made by Dr. Palmer after a conference with Frank G. McCann, heating and ventilating engineer of the New York City Board of Education. Altogether 50 schools were considered. A complete list of the schools selected is given in the report, with comments on their equipment. Those having mechanical ventilation were equipped with plenum fans which delivered the air into the classrooms near the ceiling and the air was exhausted through gravity exhaust openings near the floor. These rooms were also provided with direct radiation under thermostatic control.

THE WEATHER FOR DECEMBER, 1921

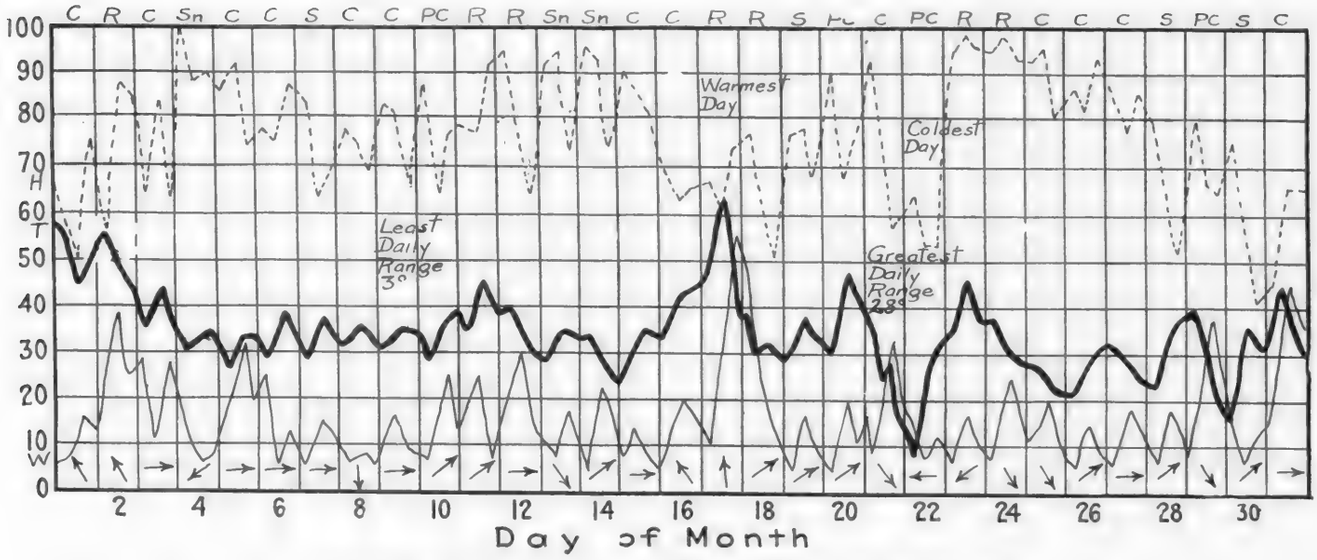
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	58	59	63	57	62
Date of highest temperature	1	18	17	1	6
Lowest temperature, deg. F	4	2	9	8	16
Date of lowest temperature	30	30	22	25	25
Greatest daily range, deg. F	32	33	28	32	30
Date of greatest daily range	21	21	21	17	17
Least daily range, deg. F	8	2	3	5	4
Date of least daily range	4	24	9	14	1
Mean temp. for month, deg. F	33.8	31.5	34	32.5	38.6
Normal mean temp. for month, deg. F	34.4	31.6	34.7	29.3	34.8
Total rainfall, in	1.89	2.35	2.36	4.63	2.89
Total snowfall, in	7.3	4.4	7.2	4.2	2.4
Normal precipitation, this month, in	3.45	3.41	2.73	2.07	2.23
Total wind movement, miles	14446	8750	8969	9971	10752
Average hourly wind velocity	19.4	11.8	12.1	13.4	14.5
Prevailing direction of wind	N. W.	W.	S. W.	N. W.	S.
Number of clear days	11	9	0	3	10
Number of partly cloudly days	5	9	5	10	6
Number of days on which rain fell	9p	15	13	17	8
Number of days on which snow fell	4	7	3	5	3
Snow on ground at end of month, in	None	0.3	Trace	None	None



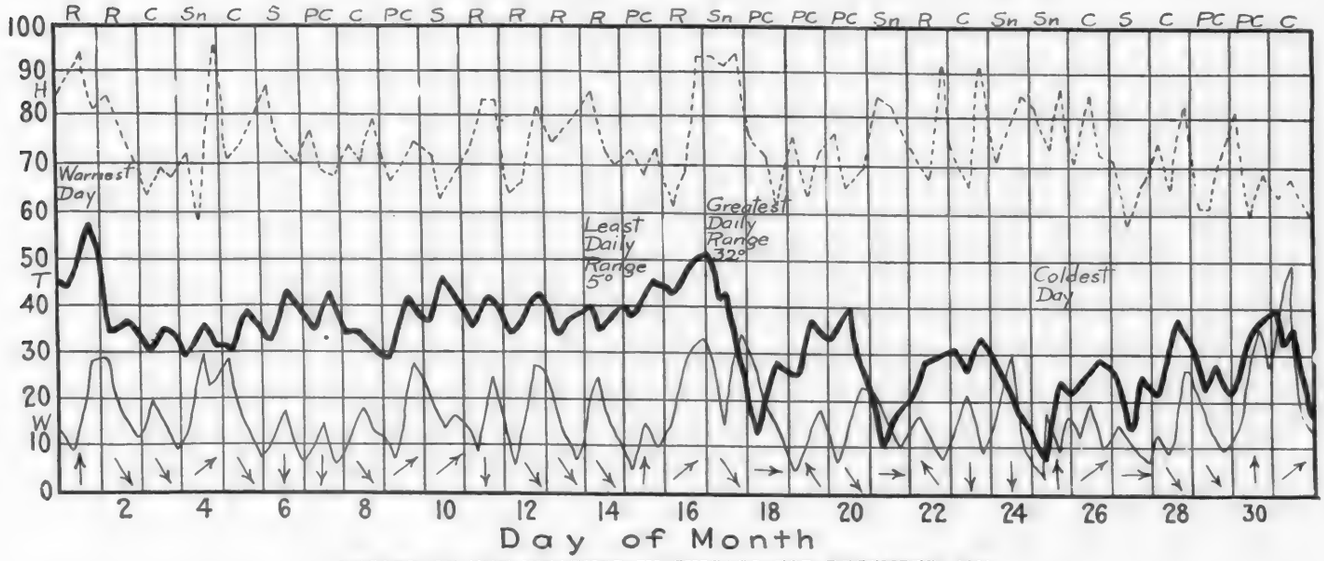
RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1921.
(Hourly Observations of Relative Humidity Recorded on this chart).



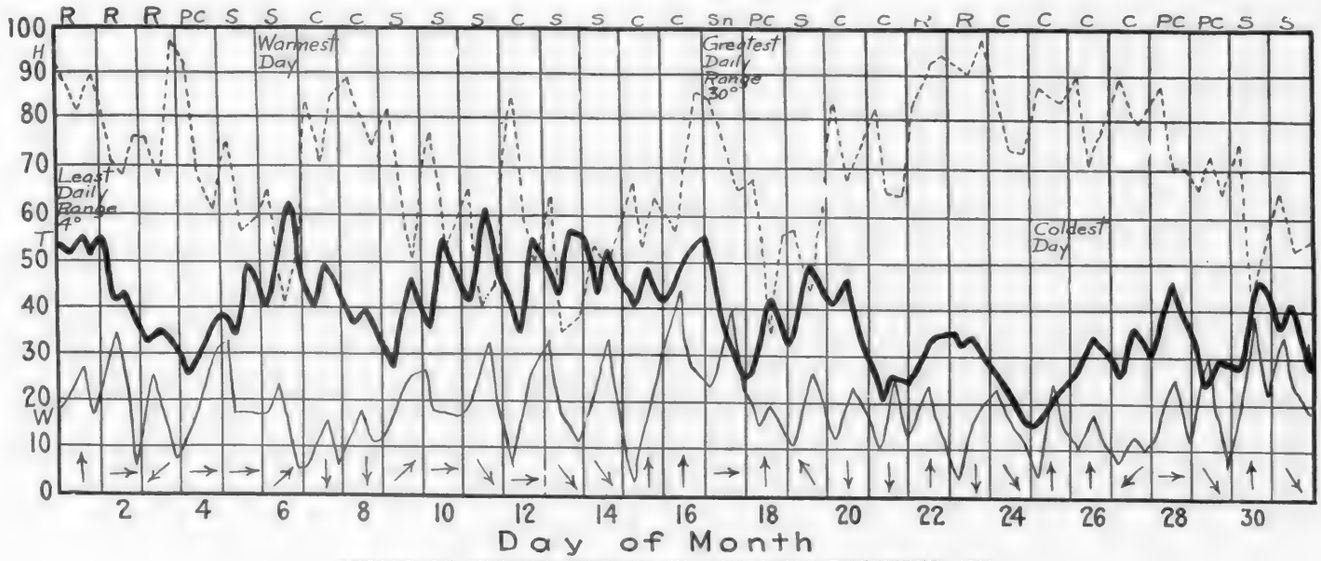
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1921.



RECORD OF THE WEATHER IN PITTSBURGH FOR DECEMBER, 1921.



RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1921.



RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1921.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken line indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

NEW YORK BUILDING CONGRESS ADOPTS CODE OF ETHICS FOR ENTIRE INDUSTRY

The New York Building Congress, at its meeting at the Engineers' Club last week, ratified a code of ethics for the building industry which, while not mandatory in any respect, points the way to curing many of the existing evils and practices now adversely affecting the progress of industry.

The code is the result of many months of study and investigation by a committee of the congress headed by William T. Parney, as chairman, and consisting of F. A. Burdett, engineer; Charles Ewing, architect; Burt L. Fenner, architect; R. D. Kaufman, banker; F. W. Lord, sub-contractor; W. G. Luce, contractor; Roswell D. Tompkins, labor representative, and Richard A. Wolff, sub-contractor.

Although only of such value to the industry as individuals may voluntarily make it, the building congress feels that the code will be of lasting benefit to all construction interests.

In an "Exposition," which accompanies the code, the building industry is described as including the owner, the real estate broker, the banker, the loan broker, the architect, the engineer, the contractor and sub-contractor, the material manufacturer and dealer, and labor. Among certain of these groups professional codes and ethics have long been in use, but the Congress believes that there is need for the development of a general code that will define fair dealings for all. No set of rules can be formulated which will particularize all the duties of all branches of the industry in their relation to the public and to teach others. The following principles should, however, govern and serve as a guide. All ethical rules may, in the final analysis, be comprehended within the statement of the Golden Rule.

GENERAL—ARTICLE NO. 1.

Sec. 1—No one engaged in the industry should, by acts, agreements or otherwise do anything that will unduly or improperly increase the cost of his work, product or commodity, nor deliver inferior quality or less quantity of work, products or commodity than engaged or contracted for.

Sec. 2—No one engaged in the building industry in any of its branches, should falsely or maliciously injure, directly or indirectly, the reputation, prospects or business of another. The repetition of rumors, not positively known to be true, is but one degree less reprehensible than the making of a statement known to be false. Nor should attempts be made to supplant another after his employment.

Sec. 3—No one engaged in the building industry should offer or accept commissions intended to influence employment, sales or contracts. Such commissions add an overhead cost which the public must eventually pay and which has not economic or moral justification.

Sec. 4—Everyone engaged in the building industry should participate in those movements for public welfare in which his training and experience qualify him to give competent and disinterested service. He should support public officials in the proper enforcement of building codes and safety regulations and should take an active interest in the formulation and improvement of such codes.

Sec. 5—No one engaged in the building industry should resort to or countenance the practice of "Shopping." By "Shopping" is meant any misrepresentation as to the relation of any bid to another bid, the use of the bid of a bidder to whom the awarder would be unwilling to award the work in order to reduce the bid of an approved bidder, or the use of fictitious bids in the efforts to reduce legitimate bids.

THE OWNER—ARTICLE NO. 2.

Sec. 1—The owner is a part of the building industry, as his interests are closely bound up with those of the members of the industry with whom he enters into contractual relations. It is, therefore, important to him, not only that the principles of fair dealing as between members of the industry should be observed by those whom he employs, but that his own conduct should be guided by the same principles.

Sec. 2—The owner should realize that the cost of estimating is a serious item of overhead expense, for which he himself must finally pay. He should, therefore, not call for a detailed estimate when an approximate estimate would serve his purpose. Nor should he call for numerous alternate estimates unless he is seriously considering the use of such alternates. He should not call for estimates from any contractor to whom he would be unwilling to award a contract. In short, he should not except to receive a service unless it is his intention to give proper consideration therefor, either through the payment of money or by giving to him who renders the service a bona fide opportunity to secure work, professional or contractual. In order that estimates may be intelligently prepared, it is necessary for the owner to see that full information and facilities such as access to site, the use of plans, adequate time, etc., are afforded to all those estimating.

Sec. 3—As the owner expects to receive full credit information as to those persons with whom he contemplates entering into contractual relations, he should accord the same privilege to them.

Sec. 4—Where an owner has retained the services of an architect or engineer, for full services including supervision, all his business relations with contractors or others engaged upon the work, whether the taking of estimates, the award of contracts, the issuance of orders for changes or instructions to the men in the field, should be carried on through the agency of the architect or engineer.

Sec. 5—While the owner is entirely free to exercise his own judgment as to the employment of an architect or engineer, or to employ the contractor to make plans and specifications for the building which he is to construct, he should understand that in the latter case, he is placing upon the contractor the moral responsibility for acting in a judicial capacity with reference to questions which may vitally affect his (the contractor's) interests.

Sec. 6—Where the owner has retained the services of an architect or engineer, he should understand that after a contract has been let, the architect or engineer becomes the official interpreter of the contract and must insist upon its faithful performance by both parties. The architect acts as designer, supervisor of construction and professional advisor to the owner, yet, as the disinterested interpreter of the obligations of both parties to the contract, it is his duty to see that both parties fully and promptly fulfill their respective obligations.

THE BANKER—ARTICLE NO. 3.

Sec. 1—The banker, whose funds are those of the public entrusted to his care, is obligated not only to conserve and wisely invest them, but also to give due weight to the community value of the improvements for which loans are desired. Especially in times when available funds are limited, he should exercise a wise discretion in placing them where they may produce the greatest community benefit.

Sec. 2—Those charged with the loaning of funds upon buildings should possess or make use of expert knowledge of the construction industry in all its branches. The lender's requirements as to building details and specifications should be clearly stated to the borrower in advance of making the loan. Loans should be based upon competent plans and estimates of cost. After construction has commenced, the lender should exercise such supervision as to be assured that the borrower is fulfulling his contract obligations, both as regards quality of construction and payments therefor. But in his interpretation of plans and specifications at any time after a loan is accepted and during course of construction he should safeguard the borrower's interests as well as his own wherever the security is not impaired. He should definitely ascertain that architect and engineer; general and sub-contractors; material men and labor are being fully paid as the work progresses in accordance with contract obligations.

Sec. 3—The machinery of financing building construction should be as simple as is consistent with the proper safeguarding of loans. The loan broker, who has a sound knowledge of building and real estate values and a right regard for the moral obligations of his calling performs a valuable service to both lender and borrower, but fees or commissions paid to other middlemen or agents who contribute no constructive service are an overload upon the building industry for which there is no economic justification.

REAL ESTATE—ARTICLE NO. 4.

Sec. 1—A broker, in presenting the advantages of a property to a prospective purchaser, should not permit his desire to make a sale to affect the accuracy of his statement. His relation to both buyer and seller should be a professional one,

and his expert knowledge should be made available to both.

Sec. 2—He should consider the proposed improvement of the site in connection with its community value or its effect upon the neighborhood. The erection of a building which will tend to deteriorate the character of a neighborhood is opposed to the public interest, and should not be furthered.

Sec. 3—He should not attempt to sell land to be improved for a definite use, if he knows that there are subsoil or other conditions which would render it unsuited to such use or unduly costly therefor.

Sec. 4—In endeavoring to interest a prospective purchaser by recommending a type of improvement and giving estimates of cost of such improvement, or estimates of the return upon the investment in improvements, he should quote no figures which are not prepared by those qualified to estimate construction and operating costs.

Sec. 5—He should not accept commissions from architects, engineers or contractors desirous of influencing retention or contracts.

THE ARCHITECT AND ENGINEER—ARTICLE NO. 5.

Where the engineer's relation to the building industry is a professional one, then it is so similar to that of the architect, that the following statement of ethics as applied to the architect applies equally to the engineer.

Sec. 1—The architect's relation to his client is primarily that of professional adviser; this relation continues throughout the entire course of his service. When, however, a contract has been executed between his client and a contractor, by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, an additional relation is created under which it is incumbent upon the architect to use his powers under the contract to insist upon its faithful performance by both parties.

Sec. 2—The architect should furnish complete plans, specifications and details in sufficient quantity and should not require the contractor or sub-contractor to make any part of such drawings or specifications without payment, other than the usual "shop details." Under shop details are not included general designing, such as of steel or reinforced concrete structures.

Sec. 3—As the architect decides whether or not the intent of his plans and specifications is properly carried out, he should take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good oversights or errors in them, nor attempt to shirk responsibility by indefinite clauses in the contract or specifications.

Sec. 4—As payments to contractors are usually based upon the architect's certificate, the architect should give immediate consideration to, and prompt action (whether favorable or unfavorable) upon the contractor's applications for payment. He cannot be a party to any desire on the part of the contractor to anticipate payments, nor on the part of the owner to delay such payments, when due under the contract.

Sec. 5—The architect should not directly or indirectly engage in any of the building trades. If he has any financial interest in any materials or device, he should not specify or use it without the knowledge of his client.

Sec. 6—The architect should not receive any commission or any substantial service from a contractor or from any interested person other than his client.

THE CONTRACTOR—ARTICLE NO. 6.

Sec. 1—In a lump sum contract, the contractor is entitled to whatever profit he may be able to derive from his ability to make favorable purchases and from the efficiency of his organization, but no desire for profit can justify his failure to completely carry out the obligations, both expressed and reasonably implied, of his contract. In a cost plus fee contract, the contractor should regard himself as the owner's agent and all his work should be conducted with the single purpose of serving the owner's interest to the fullest extent. His efforts to carry on the work efficiently and economically should be as great as though he were himself to enjoy the resulting benefits.

Sec. 2—In his relations with the architect, his attitude should be that of helpful co-operation for the owner's interest. In questions of design or the choice of materials affecting design, he should accept the architect's judgment as that of an expert and endeavor to secure the result desired by the architect. In questions relating to structural design or arrangement, or to materials and methods of construction, he should feel free to offer helpful suggestions to the architect. As the architect is the owner's professional and techinal adviser, he (the contractor) should not endeavor to influence the owner against the judgment of the architect, unless satisfied that the owner's interests are likely to be seriously jeopardized.

Sec. 3—In cases in which the architect is charged with the letting of contracts and the issuance of orders for changes, the contractor should submit his estimates to the architect and accept no orders except those issued by him.

Sec. 4—As the general contractor in seeking a contract expects fair and disinterested consideration of his proposal by the architect and the owner, he should grant the same consideration to sub-contractors and material dealers whose estimates he has used in preparing his own proposal. As a general principle, the sub-contractor whose estimate has been used by the general contractor in making his own proposal, is entitled to first consideration in the awarding of the sub-contract. This principle carries with it the obligation on the part of the general contractor to use no estimate of a sub-contractor to whom he would be unwilling to award the work and assume responsibility therefor, in the event of his obtaining the general contract.

Sec. 5—As the cost of estimating is an important element in the overhead costs of the contractor, he is entitled to a frank statement from the architect or owner as to the bona fide nature of the enterprise and the financial ability of the owner to carry it out, before incurring this expense.

Sec. 6—The desire to secure a profitable contract should not be allowed to influence a contractor's judgment or the disinterestedness of his advice. Preliminary advice and estimates should be given with the utmost care, inasmuch as the owner's decision to purchase land and erect a building is likely to rest largely upon such estimates and advice.

Sec. 7—In addition to the safeguards provided by law, the contractor should recognize that a broad obligation rests upon him to see that every reasonable provision is made for the safety and health of his employees and the public.

Sec. 8—In fairness to all elements of the industry the employer should recognize some tribunal to which jurisdictional disputes should be referred for decision.

SUB-CONTRACTORS AND MATERIAL DEALERS—ARTICLE NO. 7.

Sec. 1—No sub-contractor or material dealer should knowingly accept an order or contract that is given in good faith to cover complete cost but in reality will involve additional cost because of unusual or special trade or labor conditions or technical terms, the full meaning of which is not appreciated by his customer.

Sec. 2—He should not encourage the practice of "Shopping" by not submitting bids which are not bona fide.

Sec. 3—It is understood that where applicable the sections of Article 6—in reference to contractors—should refer also to sub-contractors and material dealers.

LABOR—ARTICLE NO. 9.

Sec. 1—Labor is a vital factor of the building industry and is entitled to a fair compensation for its output. In return for fair compensation, labor, in common with all other factors in the industry, should give the best service of which it is capable, both in quality and quantity of production.

Sec. 2—Arbitrary rules or regulations affecting the number of workmen to be employed or the installation or operation of plant and equipment and tending to artificially increase the cost of building, are economically unsound.

Sec. 3—Every man has the inherent right to choose his trade or occupation. Restrictions which interfere with his right of free choice and his opportunity to learn and qualify in his chosen business, profession, or trade, have no moral or economic justification.

Sec. 4—In the past, the great majority of strikes in the building industry have been due to jurisdictional disputes between labor unions. In fairness to all factors in the industry, labor should recognize some tribunal to which such disputes should be referred for decision, and there should be no cessation of work pending the decision.

HEAT AND HEATING EQUIPMENT IN FRANCE

By W. P. Mitchell.

There is a saying in France that "the French heat by the sense of vision rather than by the temperature of the body." Heat comfort as a commodity worth paying for is something of very recent, and still rudimentary, application in France. Had it not been for the introduction of American, German and Swiss steam and water heating exhibits at the 1900 Exposition, Paris would still be shivering.

All that was previously known was the inadequate *cheminée,* or fireplace, giving at best, as has been proven by the École des Arts et Métiers, not more than 12% in heat return for the combustible consumed, and often not more than 8%.

French stoves are even less efficient and are costly, ugly and practically unknown in the continuous fire variety. There is one type, somewhat superior, known as the "Salamander," which is a close relative of the "latrobes" which were extensively employed in Baltimore and Washington half a century ago. Aside from steam or water heating systems as have been installed in the great centres, French heating is just about where it was fifty years ago. Warm-air furnaces for either direct or indirect heating are quite unheard of.

The following observations may be said to size up the French situation climatically, nationally and temperamentally.

OLD HOUSES NOT ADAPTED TO MODERN HEATING

In France, both in Paris and the big provincial capitals, the older houses, many of them two hundred or more years old, most of them dating from three-quarters of a century back, it may be confidently said, were not conceived to be heated primarily by anything but open hearths. Whether recognized or not, this was manifestly a costly, mussy and unhealthy procedure, conducive to draft, or *courants d'air,* that bug-bear of every Frenchman or woman of whatever age. The walls of these old houses were solid masses of stone or brick, hard to heat up in winter and very difficult to modify to pass steam piping through or around, though this is by no means the reason that it has not been more widely done.

It is only in the recently-erected edifices that the installation of steam or water heating appliances has been successfully and agreeably accomplished. It is a recognized fact that a house or building should be specifically designed for heat, water, gas and electric installations. Probably not more than 25% of all dwellings outside Paris are in this category.

It is an admitted fact that steam and water heating appliances first came from abroad. One prominent internationalized radiator company has made innumerable installations, sold great quantities of its product and has had big contracts in France. More recently French firms have taken up the idea and are manufacturing on the spot, producing, curiously enough, a less elegant line of radiators much more cheaply. Especially has the rise in the dollar, as compared with the value of the franc, prevented the distribution in France of much of American manufacture that would have found a market had it not been for the disproportionate relations of the dollar and the franc.

Of significance are the following figures indicating the increase in the import of all forms of heating appliances into France during the years since the armistice.

	1918	1919	1920
Metric tons	31,207	50,239	60,938
Value in francs	6,515,000	12,948,000	15,707,000

The above observations were arrived at by a general estimate of the situation from a practical point of view. Psychologically, there are other reasons to account for the apparent apathy of the French to fall in line with new heating methods.

BETTER CONDITIONS IN HOTELS, APARTMENT HOUSES AND BUSINESS BUILDINGS.

The modern hotel, apartment house and business building are to be excepted from the charge. In many respects such are as modern as may be found in any land, though steam may be "on" for more or less brief periods, rather than continuously even at seasons when it would seem to be called for. Seldom before the sterner months of winter is heating at its high limit in France. The average American is chilled to the bone by the lack of sufficient heat in most Paris flats and rightly enough protests that his Riviera hotel only fires up when the sun goes down. Too warm to have a fire but not warm enough to go without heat, is the way the Frenchman sizes up the situation and with the balance of economy in favor of the former reasoning he leaves it at that and suffers in silence as do the strangers within his gates.

FRENCH NOT ACCUSTOMED TO CONTINUOUS HEAT.

Continuous heat has not yet got into French manners and customs,—perhaps it never will. The point which might be argued in favor of the new heating, to so call it, one which ought to appeal to the French is that collective heating is economical heating, and all the world and his wife in France to-day is perforce standing on an economy platform and fearful lest he or she may slip. This point has never been played up sufficiently in dealing with the French.

Probably the most expensive heating in France to-day is less so than that employed by the Renaissance monarchs who sought to warm up a room as big as a barn with an open hearth and an entire tree alight therein. Cardinal Richelieu's great chimney in the Palais Royal (of which there was a rumor a few months ago that it was to be turned into a hotel for Americans—think of the miles and miles of steam heating pipes this vast fabric would require) was said to burn the equivalent of a ton a day, and this for a single room. With coal at the normal equivalent of $80.00 a ton, as it was for two years after the armistice, the case would not be much different. Steam heating on the collective plan would help but to prove this is a part of the educative campaign which has yet to be undertaken in France. And on many other things as well.

NOTHING KNOWN IN FRANCE OF WARM-AIR FURNACE HEATING.

Progress and adaptation of known methods or application of new ones are absolutely necessary for comfort and well being. The fact is being recognized even in France, though but slowly. The warm-air furnace is almost unknown here. It is discredited also. The return vogue of this method of heating of detached houses in America is a recognition of its sanitary and aesthetic worth, air being drawn from without, renewed and kept in constant circulation.

The steam and water radiator has already "arrived" here, as the French say, and to that extent it has supposedly come to stay. This is an advance. Practically no advance has been made by any other methods of heating installations; nothing is available for the small or moderate-sized dwelling which for one reason or another it is not thought desirable to give an installation of radiators.

CAMPAIGN OF EDUCATION NEEDED.

For the general adoption of each and all of these systems in the French provinces in particular and, to some extent, in Paris itself a campaign of education is called for to post the public as to the virtues of modern heating methods, their economy and their convenience. To do this will take time, perseverance and money. It is true that a few years ago many firms which tried to introduce their wares in this and associated lines often came to the conclusion that it could not be made a paying proposition. The Kodak people did not come to this conclusion, nor did the fountain pen folks, the shoe and boot manufacturers, or the typewriter crowd. Is it that heating appliances and the industry in all that the word implies is so very different? One would think not. It touches the average person even more closely than either one of the specialties mentioned.

The problem is a complicated one; that is to be admitted. The rosy side of the question is remarked when we admit an undeniable change in the old traditional manners of life and a general acceptation, perhaps unconsciously, of new ideas born of the reconstruction period which France and the rest of the world are actually undergoing.

CHARCOAL STILL A COMMON COMMODITY IN FRENCH CITIES.

From our own pont of view it seems strange that charcoal is still a common marketable commodity in most French cities, including Paris. It may be well claimed that there is scarcely a single household where it is not in common use and serves for cooking purposes. Coal, in the general acceptance of the word, usually means soft coal, soft and smoky, anthracite being a luxury for the rich and at that not always readily available

and, above all, costly. Heating and cooking by gas (which costs double here what it does in New York) is still done with rudimentary appliances, and this infrequently, and with electricity not at all, almost.

This outline at least suggests a big virgin territory and market for economical, efficient heating material which will burn anything which may be had advantageously, bearing in mind the abnormally high prices of coal, coke and wood, which still endure and will, for a long time to come. The black diamond, the *pierre noir*, was a museum curiosity in France up to the time of the last of the Louis and, so far as many country homes are concerned, it is that now.

Bureau of Mines on Operation of House Heaters.

Advice to operators of house heaters, who under the keen urge of the chill blasts of January, have applied to the Bureau of Mines for a solution of difficulties experienced in caring for their fires over night, is given in a statement made by O. P. Hood, chief mechanical engineer of the bureau.

There are several ways of managing a heater, as there are several ways of driving a horse, says Mr. Hood. The general principle is quite obvious, but that principle can be applied in different ways. In the process of combustion two quantities must be supplied—coal and air. The coal we pay for, the air we get for nothing, but the quantity of air required in weight is from twelve to twenty times as much as the quantity of coal required. If we had to pay for the air we would pay a great deal more attention to the supply of this necessary material.

Given a bed of coals that are red hot, the fire will burn just in proportion as air is fed through the fuel bed. The question of keeping a fire over night is one of having a bed of fuel large enough so that at least the center of it can keep red hot without being chilled by the cold sides of the furnace, or the cold ash-pit below. If absolutely no air were fed through the fuel bed, in time the fire would go out because of loss of heat.

The problem, then, is to feed just air enough through the fuel bed to maintain temperature. The ash-pit of most furnaces leaks enough air so that if there were a considerable draft or suction above the fuel bed produced by the chimney, more air would leak into the ash-pit and up through the fuel bed than enough to simply maintain the temperature.

Too much air fed through tthe fire would burn up the coal and the fire would not keep. The problem, then, is to cut down the flow of air through the fuel bed. This can be done in numerous ways; one can put on a large amount of coal and cover the top with very fine coal, or even with ashes. This increases the resistance through the fuel bed, so that only a small amount of air flows. Another way, and a good way too, is to allow ashes to accumulate on the grate to add to the resistance of the flow of air. While this is a good way in mild weather it is not so good in severe weather, because one cannot get as much coal into the fire-box, and it is usually best to keep the fire box completely filled with fuel.

Even when the resistance through the fuel bed is increased, if the draft is maintained there is apt to be too much leakage through the ash pit and too vigorous a fire. By opening the check draft so that air can flow up the chimney without flowing through the fuel bed, the air passing through the fuel bed is greatly reduced. It makes little difference whether this is done by opening the check draft in the chimney, or done by opening the damper in the door, allowing the air to flow above the fuel bed. In the latter case, however, the air is drawn through the boiler and helps to cool off the boiler in addition to checking the flow of air through the fuel bed.

Detailed instructions regarding the economical operation of house heaters are given in certain publications on the subject, which may be obtained on application to the Bureau of Mines, Washington, D. C.

American Society of Mechanical Engineers.

An attendance of 1854 members and guests at the recent annual meeting of The American Society of Mechanical Engineers, in New York, compared favorably with that of previous years. There were five solid days of professional and technical features, into which were crowded over 100 professional events. There was also an extensive programme of social and entertainment features. The new president of the society, Dexter S. Kimball, was installed on the second day of the meeting and presided at the remaining sessions.

A live subject was placed on the program for the opening session in the form of a symposium on "Waste in Industry." One of the principal speakers at this session was Professor L. P. Breckenridge who told of the development to date of the proposed "Superpower System." He summarized the essential elements of the super-power plan as:

(a) Generation of power in plants of large capacity and high economy.

(b) Locating those plants advantageously relative to coal, mines, condensing water, load centers and coal distribution.

(c) Electric trunk lines in connection with the generating stations, both steam and water.

(d) Unified system of control in charge of a power despatcher.

(e) Delivery of primary power to electric public utility.

(f) Local distribution of energy by the public utilities.

This latter includes the essential element of a superpower plant in this or any other zone.

Predicated upon curves extended into 1930, the expected economies are:

(a) Annual saving of 50,000,000 tons of coal.

(b) Annual saving of $240,000,000.

(c) Elimination of coke and its attendant wastes.

(d) Elimination of waste of water power.

The other important effects will be:

(a) Material reduction in price of power.

(b) Considerable transfer of coal transportation from land to water.

(c) Increased flexibility of power distribution.

(d) Opportunity for coal storage, tending to stabilize production.

(e) Establishment of chemical, metallurgical, and other metal industries needing large power supply and high temperatures.

Another speaker, E. F. DuBrul, directed attention to the enormous wastes in industry caused by industrial depressions in business cycles. Within a century, he stated, this country has passed through fourteen periods of depression of greater or less extent but all involving serious loss to the investor in industrial enterprises.

"Liabilities of concerns which failed in the past ten months of 1921, he said, "aggregated $591,000,000, but even this figure does not represent the wastes of investment, loss of useful values, loss of profits and wages in concerns which did not reach the bankruptcy court.

"On all sides we are told that these losses are due to maladjustment of supply and demand, but this occurs because those responsible for supply know so little about the demand for their product that for considerable periods they purchase far more supplies than they need, and they waste capital in building plants to supply a nonexisting demand.

"If there are 9,000,000 automobiles in the country, each consuming four tires a year, or 360,000,000 tires in all, is it not waste of capital if 75,000,000 tires are manufactured for replacement?

"This kind of error must be placed at the door of management, and can be avoided only by the coöperation of managers with each other in a study of the facts as to supply and demand of the commodities they produce.

"However, the new economic conditions are compelling attention and business cycles are being studied as never before. Men are beginning to promulgate a fallacious gospel—that the end of business must be *service*, not production, not profit. Service is a means of gaining profit, and all business without profit dies—the controlling factor in management must be a financial factor—it stands the losses and it gets the profit where there is one.

"In the last analysis, therefore, the controlling waste in industry is financial waste, and it seems not to be asking too much to ask management to eradicate this waste by recognizing its duty of adjustment of supply and demand."

Another session was given over to education and training in the industries, in which papers were presented on "Professional Engineering Education for the Industries," by F. C. Pratt; "A National Policy of Engineering Education," by A. G. Christie; and "College Education as Related to Industry,' by J. E. Otterson.

Among those who took a prominent part as chairman of sub-committees for

the annual meeting were J. I. Lyle, who had charge of the informal Get-Together meeting; L. B. McMillan, general chairman.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

For a Standard Method of Testing Fans.

Announcement is made by Director F. Paul Anderson of the Research Laboratory of the American Society of Heating and Ventilating Engineers that in the near future a standard will be formulated for testing horse-power speeds and air deliveries of propeller fans.

In this connection a request was received by the society from the National Association of Fan Manufacturers to appoint a committee to act with the engineering committee of the National Association of Fan Manufacturers for the purpose of testing fans and other ventilating apparatus. It was pointed out that up to the present time there has been no standard and, therefore, no authentic comparative method of testing fans.

Illinois Chapter Discusses New Type of Central Heating Plant.

A scheme to utilize central stations for the production of water gas or producer gas to be piped to the various buildings to be heated and having in each building a separate automatic gas-fired boiler was proposed by Samuel R. Lewis at the January meeting of the Illinois Chapter of the heating engineer's society. It was stated that such an installation is now being made at one of the universities where the conditions made it necessary to locate the central station off the campus, some 2600 ft. away. In comparing the two systems, it was shown that in the cost of tunnels alone an outlay of $350,000 for pipe tunnels, if a steam or water heating system were used, could be compared with an outlay of $50,000, if cast-iron pipes were laid underground to serve as gas mains. It was estimated that three gas producer plants of 330,000 cu. ft. per hour each would take care of present needs and reasonable future expansion.

A talk on "Chimneys for Low-Pressure Heating Boilers," was given by Homer R. Linn, who quoted from the new model ordinance drawn up by the National Board of Fire Underwriters. It was voted to appoint a committee to place the model ordinance before the city authorities with a view to having it included in the city building code. Another committee was appointed to meet with the Illuminating Engineering Society to consider the drafting of a new law covering improvements in the present standards of illuminating, heating and ventilating of factories.

It was announced that the water heating layout competition, which was to have closed January 15, had been extended to February 1.

The concluding half hour of the meeting was devoted to a discussion of the novel theatre ventilation plan proposed at the December meeting of the chapter by Edmund P. Heckel.

New Officers Elected by Western New York Chapter.

New officers were elected as follows at the January meeting of the Western New York Chapter, held January 3:

President, C. W. Farrar; first vice-president, George H. Drake; second vice-president, Fred J. Weider; secretary, Roswell Farnham; treasurer, C. P. Wadley.

P. J. Dougherty, of the International Heater Co., Utica, N. Y., addressed the chapter on "Nine Basic Factors that Make or Break a Heating Plant," in which he took up the important points to be considered in the design and operation of boilers.

Lewis A. Lipman, refrigerating engineer, of Buffalo, gave an illustrated talk on recent research work in the refrigerating field indicating that this branch of work is rapidly becoming part of the heating engineers' activities.

Archer A. Landon spoke on "Encouragement to Engineers and Engineering Achievement," in which he drew freely on his long experience in this field.

President Farrar, on taking the chair, announced the appointment of the following nominating committee: O. K. Dyer, chairman; George M. Maier, Harry Welsh, H. C. Kimbrough and George W. Crane.

Metric Versus English System of Weights and Measures.

With the metric question again before a Congressional committee and the issue being raised before great national organizations throughout the country, unusual interest attaches to a report recently published of the joint committee by the National Conference Board representing interests favoring and opposed to the adoption of the metric system in the United States. The chairman of this committee was E. M. Herr, president of the Westinghouse Electric & Mfg. Co., and the other members were such well-known men as Fred J. Miller, Henry D. Sharpe, Henry R. Towne and Frank O. Wells.

Among the interesting statements in the report is one showing that the English system predominates in twelve countries with a population of nearly 350,000,000 while the metric system predominates in 37 countries, with a population of nearly 400,000,000.

The point at issue, however, as far as the American people is concerned, is brought out in the statement that "the situation in the United States is to-day quite different from the situation that confronted other important countries in making a change form their local systems to the metric. In other countries considerable confusion of weights and measures existed at the time the change was brought about. In other countries, also, the change took place before the industrial life of the nation had become organized and standardized to the extent that modern production makes necessary. The countries outside of Europe which have adopted the metric system have little or no organized industry in the modern sense.

"In the United States to-day there is, in the first place, no fundamental confusion with respect to weights and measures. Furthermore, the United States unquestionably stands in the forefront of the great industrial and manufacturing nations. Its highly organized industry is based on the English units of weight and measure, and most of its vast technical literature is written in this system. All things considered, therefore, there does not exist in this country the great incentive to a change found in other nations where confusion was the rule until the metric system was adopted.

"In consequence the situation to-day narrows itself down to the question whether the advantages to be gained warrant the compulsory adoption of one unified system, namely, the metric, in the place of another unified system, namely the English which latter is moreover the established system and enters so intimately into the present industrial organization of the nation. It is not a question of allowing the use of the two systems side by side and giving the metric the opportunity of supplanting the English, because the metric has, as a matter of fact, been a legal system in the United States since 1866, and any one who so desires and finds it more convenient and practical may use it. The question is, shall the United States discard the English system of weights and measures entirely and absolutely and in its place substitute by compulsory law the metric system as the sole standard?"

Treatment for Carbon Monoxide Poisoning.

In a bulletin issued by the Bureau of Mines and calling attention to the fact that carbon monoxide poisoning is one of the most widely distributed and most frequent causes of industrial accidents, a method is given of treatment which the bureau has used successfully for a number of years.

The first and most important thing, it is stated, is to get the poison out of the blood. Every moment that it shuts the oxygen out of the hemoglobin adds to the chances for failure of respiration and failure of the heart. Every minute that the tissues are supplied with only part of the oxygen they need increases the danger of their degeneration and permanent damage. Both to save life itself and to prevent ill health in the future, it is of vital importance to eliminate carbon monoxide from the blood as rapidly as possible.

The first step is to get the victim away from the atmosphere of carbon

monoxide which he is breathing; the next is to supply him with oxygen. This may be done by getting the patient into fresh air, but only one-fifth of air is oxygen. If a tank of pure oxygen is available, it is far better to use it, as the action is much faster and the after-effects, especially the headache, are much less severe and not so prolonged.

Continue artificial respiration, if necessary, for at least three hours without interruption, or until natural breathing has been restored or a physician has arrived. Even after natural breathing begins, carefully watch that it continues. If it stops, start artificial respiration again.

While the administration of oxygen is by far the most important factor in the treatment and cannot be over-emphasized, other things should be done to help the patient. He should be kept *quiet* and *lying flat,* to help his weakened heart. when he revives, he should *not* be *allowed* to *walk* about or in any way *exert* himself, for there is danger of heart failure. Heat from safety lamps, hot-water bottles, or warm bricks, rubbing the arms and legs, and keeping the patient well covered with blankets all help the circulation, and aid in tiding the body over a period of low vitality. The safety lamps, hot bricks, etc., should be well wrapped in cloth or paper as a precaution against burning the patient. Other stimulants, such as hypodermics of caffein-sodium benzoate or camphor in oil, should not be administered except by a doctor, after he has considered the possibility of over-stimulation and consequent collapse. The patient should be kept in bed for a day at least. Later he should be treated as a convalescent, being given plenty of time to rest and recuperate. Just how long this time should be depends on the severity of his poisoning and should be decided by his physician.

Complete details of methods employed in the treatment of carbon monoxide poisoning, including a description of the Schaefer method of artificial respiration, are given in a report which may be obtained by applying to the Bureau of Mines, Washington, D. C.

Heat by Radiators and Get
Real Home Happiness
Many a family, for the first time realizes its dream of comfort, with the installation of a hot water, steam or vapor heating plant. Winter evenings are more thoroughly enjoyed: With all the rooms genially warm, and chill and drafts unknown, the happiness of the family circle is complete.
Father considers his hot water, steam or vapor heating equipment as the real guardian of his loved ones and his pocketbook. When he's away, he knows that the home is uniformly and safely warmed and the family health protected in the most economical way.
"Heat by Radiators," is the healthiest heat at the lowest cost.
(YOUR NAME HERE)
Phone No.
Address
The National Trade Extension Bureau Service.

ANOTHER "HEAT BY RADIATOR" SUGGESTION.

NATIONAL TRADE EXTENSION BUREAU

"Heat by Radiators."

Suggestions for a continuation of the "Heat by Radiators" compaign are contained in the Monthly Service Bulletin of the National Trade Extension Bureau. Heating contractors are urged to get together with their competitors in their locality on this campaign, but to go it alone, if necessary.

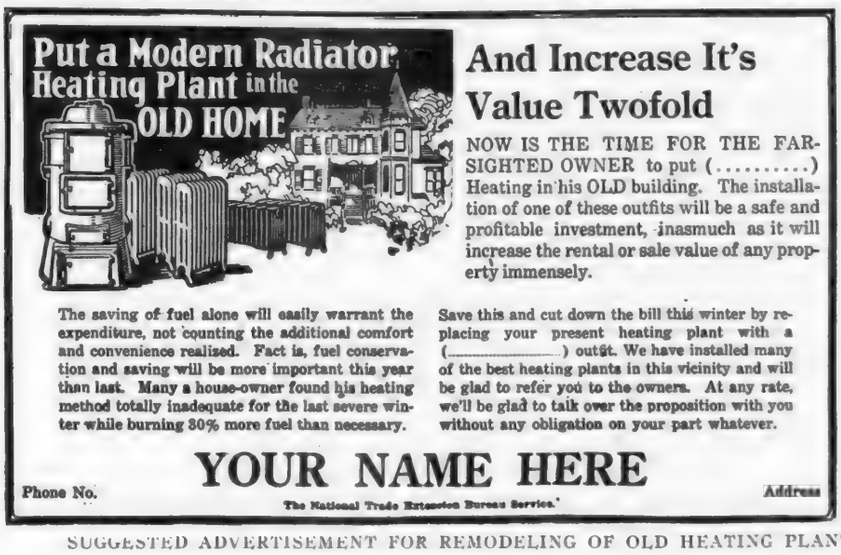
The bureau has prepared a number of newspaper advertisements, as well as sample forms of circular letters and illustrations and explanations of window displays, supplemented by illustrations of movie slides. Cuts of the illustrations are obtainable from the bureau in the form of matrices or mats, which need only to be mounted to make them available for use in the printing office.

One of the most effective window displays shows a mantel fire-place, which may be built of light lumber or beaver board, with the beaver board lined and colored to indicate brick face or tile. An ordinary open-fire grate can be let into this beaverboard. After being placed and supported in position, a background for it may be provided by using cardboard, painted with lamp black.

In almost any town the local printer is able to supply printed slips of paper which would serve the purpose, indicated in the illustration, of the stage money in the coal scuttles and in the fire-place. It is not necessary to fill the coal scuttles completely. A false bottom of pasteboard can be inserted up toward the top of the coal scuttle, and the stage money placed on top of the false bottom.

By concealing a good-sized electric fan under-neath the grate and blowing up through the fire, an effect of flames can be produced. Make small streamers cut from orange and scarlet crepe paper. Paste these streamers to the edges of the stage money in the fire-place. In doing this it should be remembered that the stage money in the fire-place should then be pasted to lumps of coal or something else that will hold it down when the draft from the fan hits it.

It is further recommended that "Heat by Radiators" posters should be pasted to the windows as indicated in the photograph. Other similar displays are illustrated and described in the bulletin.


Put a Modern Radiator Heating Plant in the OLD HOME
And Increase It's Value Twofold
NOW IS THE TIME FOR THE FAR-SIGHTED OWNER to put (.....) Heating in his OLD building. The installation of one of these outfits will be a safe and profitable investment, inasmuch as it will increase the rental or sale value of any property immensely.
The saving of fuel alone will easily warrant the expenditure, not counting the additional comfort and convenience realized. Fact is, fuel conservation and saving will be more important this year than last. Many a house-owner found his heating method totally inadequate for the last severe winter while burning 30% more fuel than necessary.
Save this and cut down the bill this winter by replacing your present heating plant with a (.....) outfit. We have installed many of the best heating plants in this vicinity and will be glad to refer you to the owners. At any rate, we'll be glad to talk over the proposition with you without any obligation on your part whatever.
YOUR NAME HERE
Phone No.
Address
The National Trade Extension Bureau Service.

SUGGESTED ADVERTISEMENT FOR REMODELING OF OLD HEATING PLANTS.

Dates for the T. E. B. 1922 Sales Drives.

Supplementing the announcement by the National Trade Extension Bureau of its sales promotion program for 1922, details have now been received of the dates for the various campaigns. As previously announced, January and February are being devoted to a campaign of an educational nature to promote and establish better relations and understanding between the public and the heating and plumbing contractors. This is being carried out through the use of advertisements, newspaper editorials and displays. A special "Campaign Calendar" has been made up with all of the campaign drives emphasized. These are being sent out to all heating and plumbing contractors, jobbers and manufacturers.

The week of March 20-25, inclusive will be devoted to a "Heat by Radiator" campaign, with special emphasis laid upon cottage heating and remodeling heating systems of old homes.

April 24-29, inclusive, will be used for the "Bath in Every Home" campaign.

May 22-29, inclusive, will see the campaign for "Hot Water for Every Need."

RADIATOR HEAT
MEANS
Cleanliness
Durability
Safety
Economy
As an Added Comfort, Install
(——) AIR VALVES
Radiators with (.....) Air Valves always heat from end to end. Radiators farthest away from the boiler, heat up just as quickly as those nearest. There is no "spitting, banging, hammering"—no water from (.....) valves to mar the floors and rugs.
(.....) Air Valves will more than pay for themselves in one winter by cutting coal costs.
(.....) Air Valves cost but little and can be installed without any radical changes in the heating system.
Don't wait till winter catches you—see us today.
(YOUR NAME HERE)
Phone No.
Address
The National Trade Extension Bureau Service.

SUGGESTION FOR AIR VALVE ADVERTISEMENT.

June 19-24, inclusive, carries the campaign for "A Bath A Day."

August 21-26, inclusive, will bring the campaign for "Running Water on the Farm."

September 25-28, inclusive, will be used for the campaign on "Vacuum Cleaners," with special stress upon the advantages of built-in equipment.

September 25-30, inclusive, will be devoted to the "Heat Regulation" campaign.

October 23-28, inclusive, will be taken advantage of for the campaign on "Vacuum Cleaners," with special stress upon the advantages of built-in equipment.

December 3-8 and up to Christmas Day will be used for the campaign on "Domestic Appliances," emphasizing the logic of giving the housewife as a Christmas gift something that will permanently reduce her household labors.

In each of the special sales campaigns the bureau will supply to the heating and plumbing dealers a practical plan covering the necessary advance work and leading up to an intensive advertising and sales drive of one week, as a climax for each campaign.

New Direct Radiation Tables.

Under the heading of "Direct Radiation Tables" the *Journal* of the American Society of Heating and Ventilating Engineers for December, 1921, publishes a set of tables giving the heat loss from several standard types of radiators, together with a table of conversion factors and examples in the use of the tables in the solution of practical problems. The tables have been prepared by Director Anderson of the society's Research Laboratory, F. C. Houghton and Louis Ebin, and are based on experimental data collected by the late Director John R. Allen and Professor Frank B. Rowley of the University of Minnesota. This, it is stated as in keeping with a purpose to have the Laboratory put all of its newly-collected data into standard usable form as soon as possible.

The factors that have been taken into consideration in compiling the tables include the ratio of the enveloping to the actual surface, the absolute temperature of the steam in the radiator, the absolute temperature of the air and objects in the room receiving the heat, the temperature of the steam in the radiator, the temperature of the air and objects in the room, a constant for cast-iron radiators and a constant for the radiators, which, multiplied by the expression $(t^s - t^r)$ gives the heat loss by convection per square foot of rated surface per hour.

The tables are arranged so that the total B. T. U. per hour can be read direct for various heights and for various numbers of sections.

THE "DOUBLE-COMBINATION" IDEA AS APPLIED TO ENGLISH HEATING APPARATUS

Spurred on, no doubt, by the growing seriousness of the fuel situation and the urgent need of economy in the use of coal, the English heating industry is developing a line of apparatus which is decidedly novel, to say the least, but which, on second thought, may be pointing the way towards a similar development in this country. The idea is to make one fire do as much work as possible and, among other things, to serve for both heating and cooking purposes.

A typical design of this kind of heater which appears in *The Plumber and Journal of Heating,* of London, is shown in Fig. 1 and the manner in which it is used for warming purposes in Fig. 2. In the Ideal Cook "Cookanheat," has three radiators, it will be noticed that the arrangement also serves to heat water in a storage tank. It is stated that the fuel consumption is no more than 6 lbs. per hour during cooking and from 3 to 4 lbs. per hour at other times. The latest form of this heater, which is known as the Ideal Cook "Coopanheat," has three sections instead of two, and the smoke-hood is now about centrally placed on the rear edge of the hot plate and is fitted with a hit-and-miss draft regulator.

Another form of boiler (Fig. 3) is designed for both house-heating work and for furnishing domestic hot water without the two waters mixing. At the same time this boiler can be used for indirect heating of the domestic water supply only. This apparatus, which is known as a "Combination Domestic" boiler has an annular copper water chamber within the iron water-way shell of the boiler and independent connections are provided for both chambers, one set from the copper chamber for domestic service, the other from the outer water-way for heating work. One feature that is important in connection with this arrangement is only one supply should be used so that the water jacket and the chamber within it may both carry water at or about the same pressure.

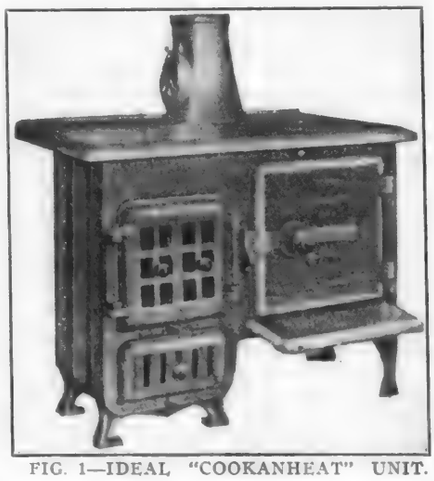


FIG. 1—IDEAL "COOKANHEAT" UNIT.

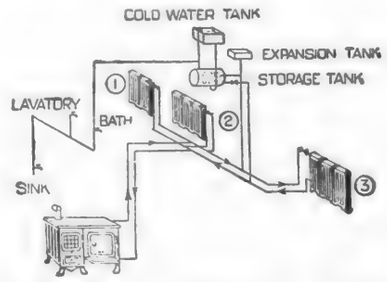


FIG 2.—TYPICAL LAYOUT OF "COOKANHEAT" SYSTEM.

Another design is a combination of a boiler and gas cooker. By an ingenious arrangement the waste heat from the boiler is diverted around the oven which is thus raised to a high temperature. To attain cooking heat the gas is turned on for a minute or two. It is then turned off and the required cooking temperature is maintained by the heat from the coke or anthracite boiler.

FIG. 3—COMBINATION "DOMESTIC" BOILER.

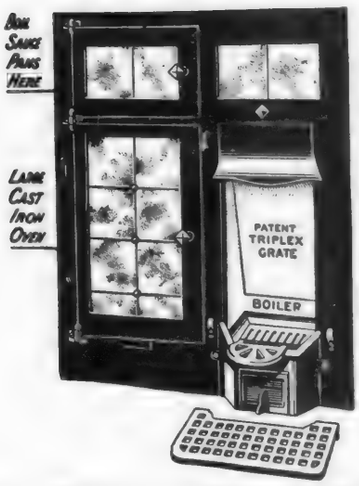


FIG. 4—TRIPLEX COMBINATION GRATE AND WATER HEATER.

Another device is known as a "Triplex" grate and is a form of combination grate, with oven and water heater and in some a "boiling hot closet." In this particular design the fire has a downward pull through it so that the smoke is carried through the hot fuel and consumed. Although this has been on the market for some time, it is now the object of renewed attention in response to a public demand.

Evidence that the choice of odd names for heating and ventilating devices is not yet exhausted is shown in the "Ventiheta" (Fig. 5) which is built somewhat along the lines of the unit heaters developed in this country. It is intended to take in outdoor air through an opening in the wall, but is provided with a damper to permit recirculation of the indoor air. It is made in different heights and in cylindrical or square form. The heating provision is in the base and three models are made for gas, electricity or oil heating. The heating appliance itself is separated from the fresh air chamber, resulting in an accelerated air movement and at the same time imparting heat to the air as it ascends the tube. The flow of air may be regulated by a hit-and-miss regulator in the base beneath the heating element.

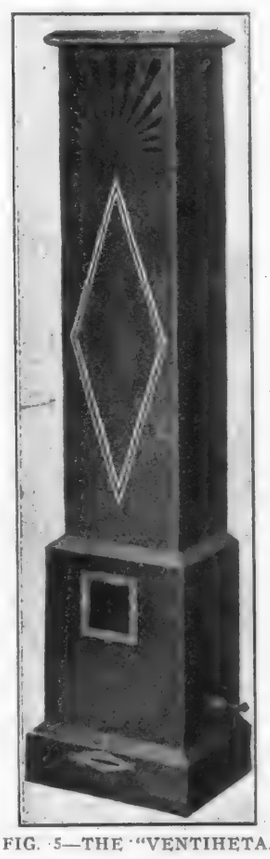
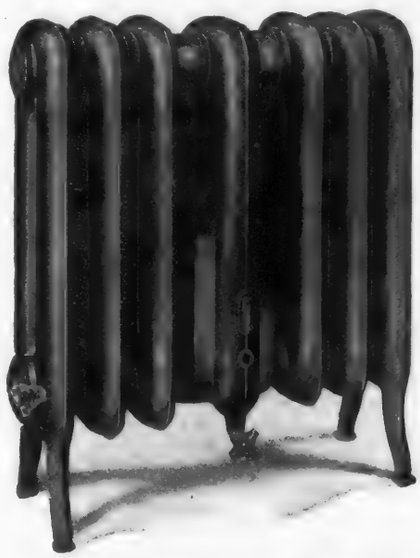


FIG. 5—THE "VENTIHETA."

New Apparatus and Appliances

Ra-Do Fumeless Gas Radiator.

A gas radiator in which the products of combustion are not vented but are converted into a breathable air by a chemical composition, has been brought out by John C. Tate, of the Tate Chemical Co., Oakland, Cal., and is being manufactured by the Baird-Bailhache Co., 478 Sutter St., San Francisco, Cal. The chemical called Fumo compound and is likened composition used for this purpose is by the inventor to the chemical used in the gas masks during the war. The difference, it is stated, is that the mask is placed on the heater instead of on the individual.



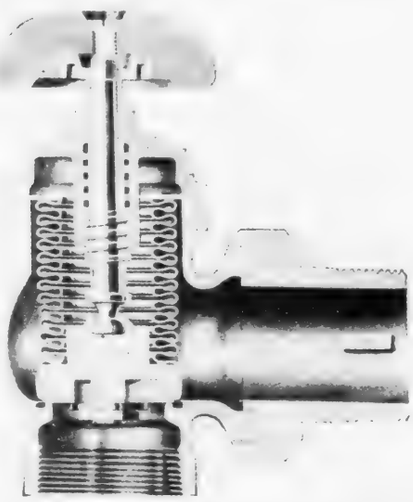
THE RA-DO FUMELESS GAS RADIATOR.

The Ra-Do gas radiator is a complete unit in itself and can be used wherever an ordinary gas radiator would be applicable. It is equipped with thermostatic control by which the heat may be turned on at a predetermined hour night or day and a fixed temperature maintained during any given period. The center section containing the burner serves as a miniature warm-air heater. It is open at the bottom where the air is drawn in. On being heated the air moves rapidly upward from the burner, circulating through each section of the radiator until it enters the retort containing the purifying chemical, from which it passes into the room.

The burner itself is of the Bunsen or atmospheric type. The radiator is regularly made in three, five and seven sections. The three-section type is described as especially suitable for rooms up to 15 x 20 ft., with 10-ft. ceilings. The five-section is capable of heating two ordinary-sized rooms connected by double doors and for larger single rooms up to 20x25 ft., with 10-ft. ceilings. The seven-section type is suitable for public buildings, such as auditoriums, clubs, schools, stores and for rooms up to 20 x 40 ft., with 10 ft. ceilings.

A New Packless Radiator Valve.

Under the name of the Detroit packless radiator valve, bellows type, the Detroit Lubricator Co., Detroit, Mich., has placed a new design on the market which is described as a high-grade radiator valve that cannot leak. It is suitable for steam, water, vapor and vacuum heating systems. As will be seen from the accompanying illustration, the moving parts of this valve incident to the opening and closing are sealed in a closed compartment made of a metal bellows. This is arranged to expand and contract to the extent necessary for opening and closing the valve, so that steam or water in the system is excluded from any contact with the working parts, especially the stem. In addition, no air can get into the system through the radiator valve, which is so necessary in a vacuum system. The metal bellows is described as of an improved type that will last as long as the heating plant itself.



NEW DETROIT PACKLESS RADIATOR VALVE, BELLOWS TYPE.

A new design of handle is offered for the first time. It is a hard, rubber-finished molded type, being non-breakable and non-conductive of heat. It will not work loose, it is added on the stem. The

workmanship and finish of the valve is in accordance with the usual Detroit Lubricator Company standard. Roughing-in dimension are included of angle, globe and corner types.

R. V. T. Return-Line Pump.

In line with the demand for simplicity and economy of operation, the R. V. T. return-line vacuum pump has been placed on the market by the Chicago Pump Co., Chicago, Ill. The R. V. T., it is stated, is the result of much experimenting conducted by the company, and while it is obtainable at the usual prices for outfits of this type, it is described as being unusually simple in operation and has shown its ability to reduce operating costs.

Among the points emphasized by the manufacturers are that the individual air and water pumps are driven by individual motors; there is double automatic control of each pump and motor separately; the pumps, motors and receivers are mounted on one base, with all connections made before leaving the factory; and the air pump runs in an oil bath, with consequent lengthening of service.

The use of individual motors serves to lessen the consumption of current, as each runs only when necessary. This, of course, results in increased life to the whole outfit. Since the air and water outfits are independent of each other a possible breakdown of one does not hamper the action of the other. For these reasons localization of troubles results in much less difficulty in repairing.

Sylphon Radiator Air Valve.

A valve designed to solve the problem of expelling air from a radiator without permitting the escape of steam or water has been perfected by the Fulton Co., Knoxville, Tenn., and is being marketed under the name of the Slyphon radiator air valve. Like other products of this company, the new valve is operated by the "Sylphon" a one-piece drawn brass bellows which is filled with a volatile liquid. In the presence of air this bellows contracts, allowing the air to escape freely, but closing against steam. A large area float is used to prevent the escape of water.

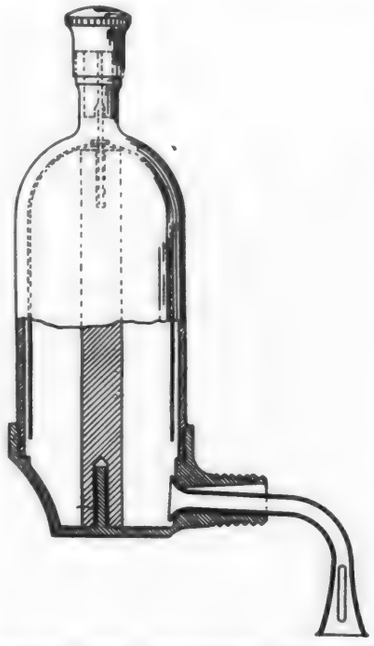
Being made of one continuous piece of metal, the Sylphon is free from soldered joints. This construction, it is stated, gives it many advantages. It has considerable flexibility, which means an unusually long stroke. When the valve is closed, it is tight and when it opens, it opens wide, thus eliminating hissing or sputtering from a partially closed valve. The absence of solder, it is pointed out, gives greater strength and longer life.

The base of the Sylphon air valve is cast of brass sufficiently heavy to prevent leakage or the possibility of its being broken off. The complete valve is small and neat in appearance.

Self-Draining Radiator Air Valve.

One disadvantage of the ordinary air valve for use on steam radiators is that occasionally the valve will become waterlogged through collection of condensed steam. In this condition it invariably fails in its principal function and the result is that the air stays in the radiator and excludes steam needed for heating.

The feature of the Etzel air valve, recently patented by Frank E. Etzel, of Montclair, N. J., is a design of a drainage tube which prevents such clogging. A section of this tube, as inserted in the ordinary air valve, is shown in the accompanying illustration. By boring the valve nipple on a taper the tube is given a downward slant which favors drainage. By flaring the tube ends to bell shape at both ends, as shown at B, is prevented

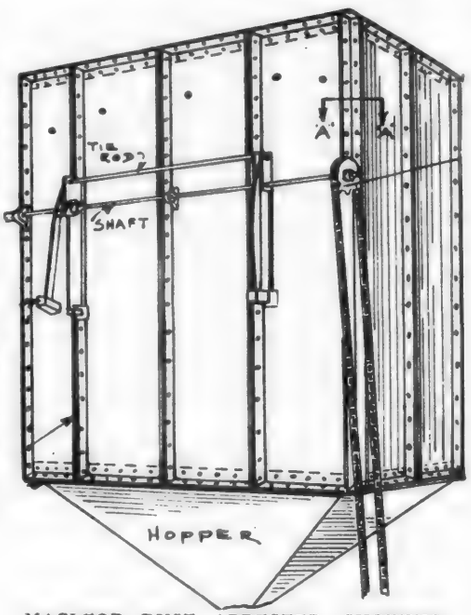


SELF-DRAINING RADIATOR AIR VALVE.

the collection of drops of water at these ends and consequent obstruction of air and steam flow through the tube. By slotting the tube, as shown at A, is provided an extra safeguard against clogging, since even if the lower end of the tube should become closed, there would still be means of air and steam flow through these slots.

A Multiple Screen Dust Arrester.

Fabric screen air filters are of two main types, the series design in which the screens are joined end to end and set at an acute angle to each other (providing but one dust barrier between intake and exhaust sides and therefore low resistance to the air stream) and the multiple design in which the screens are set parallel to each other (providing a number of dust barriers between intake and exhaust with a correspondingly higher resistance to the air stream). The Macleod Type F dust arrestor, shown in the accompanying illustration and

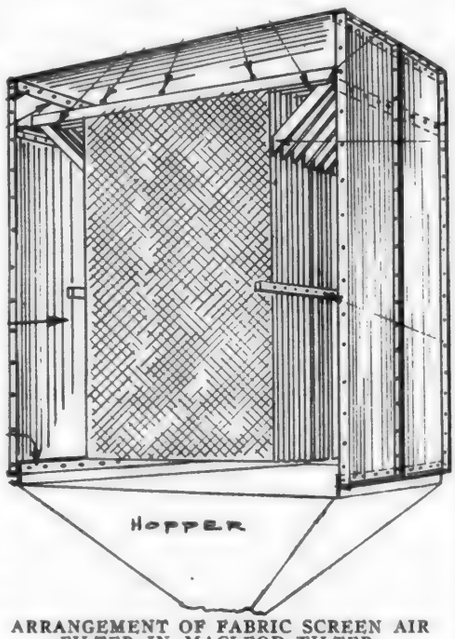


MACLEOD DUST ARRESTER, SHOWING KNOCKER BARS AND HAMMERS.

manufactured by the Macleod Company, Cincinnati, O., is of the latter type. The screen frames in this device are made up in separate units and then joined together by means of two knocker bars, one on each side, which are fastened to each screen section by means of screws. Twin hammers actuated by a cam mechanism are arranged to strike against the end of the knocker bars and produce vibration of the screens that will precipitate dust from their surfaces into the hopper below. The cleaning of these screens twice a day is recommended and the hopper is supposed to be emptied daily when the arrestor is in constant service. The case enclosing this apparatus is of sheet-metal with angle-iron bracing.

New Books.

HANDBOOK OF BUILDING CONSTRUCTION, by G. A. Hool and N. C. Johnson, editors-



ARRANGEMENT OF FABRIC SCREEN AIR FILTER IN MACLEOD FILTER.

in-chief, containing data for architects, designing and constructing engineers and contractors, has been published in two volumes. Volume 1 is given over to structural theory, while Volume 2 takes up in detail construction methods and equipment, building materials, estimating and contracts, heating, ventilating, power work, water supply, sanitation, electrical equipment, lighting, elevators, etc. Price $10.00. Published by the McGraw-Hill Co., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

New Publications.

EPIDEMIOLOGY AND PUBLIC HEALTH, described as a text and reference book for physicians, medical students and health workers, by Victor C. Vaughan, M. D., LL. D., assisted by Commissioner of Health Henry F. Vaughan of Detroit and Dr. George T. Palmer, epidemiologist for the Detroit Department of Health, has been published in three volumes by C. V. Mosby Co., St. Louis, Mo. The author, Dr. Victor C. Vaughan, has recently been called to the National Research Council as chairman of the medical section. He was for more than 40 years professor of hygiene in the University of Michigan. Size 6½ x 9½ in. Pp. 700 each, profusely illustrated with charts, diagrams, line drawings and half-tones. Silk cloth binding. Price per set, $27.00.

Trade Literature.

JA-NAR', the ornamental radiator cover and temperature controller, is featured in a handsome circular, in colors, published by the Fulton Co., Knoxville, Tenn. the fact that it is more than six years since the company originated this product, during which time it has given wide satisfaction, is presented as evidence of its value. In construction the Ja-Nar' is a specially-finished heat-insulated cabinet, made of furniture steel and intended to be placed over any ordinary steam or water radiator. It is fitted with louvres and is furnished both with and without automatic heat control. The automatic control type is equipped with the Sylphon thermostat, which is actuated by the natural expansion and contraction from heat and cold. The thermostat is placed in a separate compartment of the cabinet and is entirely insulated from the radiator, responding only to the room temperature. It operates to open or close the series of shutters inside of the cabinet.

PULLS THE PROBLEM THROUGH THE ROOF is the expressive description of the action of the Allen Air-Turbine ventilator, as given in a recent circular issued by the Allen Air-Turbine Ventilator Co., Detroit, Mich. This device is described as a true rotating air-driven suction turbine. It is unaffected, it is stated, by snow, ice, sleet or rain and is described as positively leakproof. The upward suction force of the rotating turbine, it is added, make downdrafts a mechanical construction impossibility. The circular gives displacement figures for wind velocities of 4 and 8 miles per hour and for ventilator sizes running from 8 in. to 48 in. diameter. There is also included an impressive list of users.

WEATHER VEIN for December, 1921, the monthly periodical of the Carrier Engineering Corporation, Newark, N. J., is featured as a tobacco number. An interesting account is given of the development of tobacco manufacture and of the application of the company's air conditioning equipment in this field under the direction of A. C. Buensod. A number of notable installations are briefly described. "The Story of the Cigarette" is also told in this number.

HOLLY AIR FILTER, made by the Holly Pneumatic Systems, Inc., New York, is featured in newly-issued circular matter. Among the advantages mentioned for these filters is their large filter area in a small space, their low resistance whereby it is possible to filter 100,000 cu. ft. of air with 1 H. P., their arrangement whereby each pocket can be removed independently, the automatic method of maintaining the tension of the cloth, and the positive seal of pocket heads. In the construction of this filter, a special filter cloth is spread over wooden or metal frames and fastened tightly at their heads, leaving a space for air passage. The cloth is kept under an even tension by an automatic stretching device. The raw air, uniformly distributed, enters between the filter leaves and passes through the cloth pockets. All suspended matter, such as dust, soot and other impurities, is deposited on the surface of the cloth. The purified air leaves the filter through slots in the bottom. The filter is built in two standard types. It is featured as especially adaptable to heating and ventilating systems, as well as drying and cooling installations, refrigerating plants and other industrial and chemical processes.

HOLLY AIR FILTER WITH STEEL HOUSING, CAPACITY 11,000 SQ. FT. OF AIR PER MINUTE.

STRUCTURAL SLATE FOR SCHOOL BUILDINGS, being one of the chapters on structural slate which are being published by the Structural Service Bureau, Philadelphia, Pa., acting for the producers of the Pennsylvania slate district, has made its appearance and is in line with the previous chapters which, as previously stated in these columns, represent an advanced form of technical catalogue that may well serve as a model of its kind.

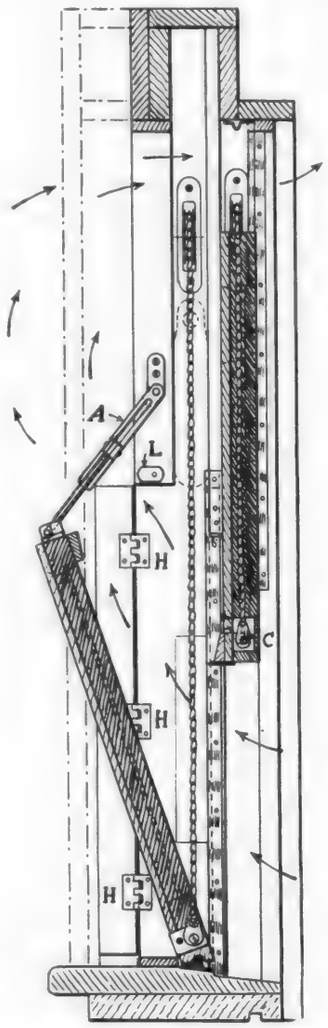
PATTERSON FEED-WATER HEATERS are presented in a well-compiled catalogue issued by the Patterson-Kelley Co., New York, and featuring the Patterson-Berryman feed-water heater and purifier and the Standard feed-water heater. Both are of the instantaneous water-tube type and each is designed to feed water from 40° F. to from 200° to 212° F., depending upon local conditions. The shells of the smaller-capacity types are of cast-iron and those of larger capacity, steel boiler plate. The outstanding feature of the heaters, however, are their heating surfaces in the form of nests of Ω-shaped, seamless-drawn copper tubing. Both ends of each tube are expanded into forged steel tube heads so that each tube is free to expand and contract and contract independently of any other tube. Various types of each heater are shown in the catalogue, with diagrams of exhaust connections. The usual data are included on each type. Size 6 x 9 in. Pp. 16. Another booklet

issued by the Patterson-Kelley Company, entitled "Hot Water—The Patterson Way" is made up of photographic reproductions of important buildings which are equipped with Patterson apparatus in the form of the Patterson combined water heater and storage tanks. It makes an impressive display. Size 6¾ x 11 in. Pp. 32.

SARCO PRODUCTS, including steam traps, radiator traps, temperature control, thermometers and strainers are presented in their natural colors in a recent circular issued by the Sarco Co., Woolworth Building, New York. The natural colors used bring out very strikingly the brass parts of each device. This gives fresh interest to the company's well-known Steam Trap Sarco and Radiator Trap Sarco which, it is stated, are now being manufactured and sold at competitive prices as a result of the company's large manufacturing facilities. The Sarco indicating thermometer is featured as a new device which the company is now manufacturing under the Fournier patents.

STANDARD COMFORT WINDOW HARDWARE, devoted to the product of the Standard Comfort Window Corporation, 426 Broome St., New York, is treated in a recent catalogue. These appliances are designed for new and old double-hung windows and are urged as a solution of the ventilation problem in hospitals and other buildings. The claim is made that they admit fresh outdoor air without drafts even during periods of rain or snow. Another point mentioned in their favor is that they may easily be cleaned from the inside, eliminating drafts from open windows during cleaning. The equipment includes weather-stripping made of zinc. The sash stops on the right and left side of the window are cut and hinged on a vertical axis and opened like a book, as shown, to allow the lower sash to be tilted in-ward at the meeting rails. When the upper sash is drawn down slightly the incoming fresh air is deflected upward by the tilted lower sash, enabling the used air to escape at the highest point. Detailed drawings are included of Standard Comfort windows, and the Proceedings of the American Society of Heating and Ventilating Engineers, as well as THE

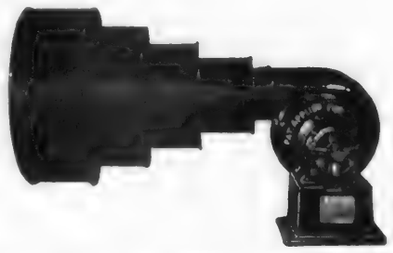
HOW LOWER SASH SWINGS INWARD IN STANDARD COMFORT WINDOW.



SECTIONAL VIEW OF A STANDARD COMFORT WINDOW ADJUSTED FOR VENTILATION.

HEATING AND VENTILATING MAGAZINE, are drawn on to support the claims for the advantages of fresh outdoor air. Size 6⅛ x 9⅛ in. Pp. 12.

SIROCCO CIRCULATOR for warm-air furnaces is an interesting device illustrated and described in a circular received from the American Blower Co., Detroit, Mich. As described in the circular, under the title of "Small Blowers in Combination with Furnaces for Domestic Heating Plants," by F. R. Still, the device is intended to relieve conditions where warm-air furnaces fail to heat come portion of a building, or require forcing of the fire to obtain sufficient heat to give satisfactory results at times. The smallest unit of the type shown has a maximum capacity of 750 cu. ft. of air per minute, requiring a 1/20 H. P. electric motor. At full load this motor requires about 38 watts, or about 75% of the current required for an ordinary incandescent lamp.



SIDE VIEW OF SIROCCO CIRCULATOR.

It can be started or stopped by any of the ordinary switches used and, it is stated, is as nearly noiseless as any mechanical device can be made. It is figured that it costs about ⅛ of a cent per hour to run the fan. The arguments for economy in the use of a fan in connection with a warm-air furnace system are supported

THREE-QUARTER VIEW OF SIROCCO CIRCULATOR.

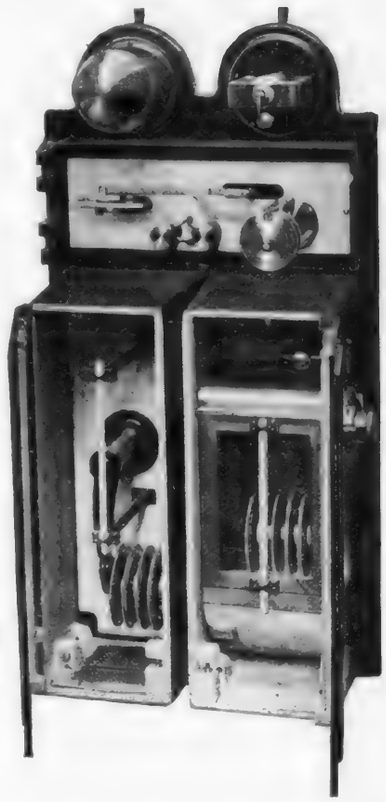
by quotations from a bulletin of the University of Illinois Experiment Station in which it is stated that "the efficiency of heating surfaces may be increased and the capacity of a furnace materially raised, by the use of a fan to give positive circulation of air over the surfaces."

TUBE FACTS, replete with information regarding brasses, bronzes, nickel silvers and pure nickels bearing on the manufacture of seamless tubing, is the title of a new publication received from Scovill Mfg. Co., Waterbury, Conn. That this information will serve a good purpose is brought out in the statement that many engineers specify "brass" condenser tubes for their surface condensers without realizing that the brasses, which are essentially alloys of copper and zinc, may have a copper range from 56% to 95%. It is further pointed out that some of the alloys, Muntz metal, for example, which contains 60% copper and 40% zinc, are wholly unsuited to resist corrosion in sea water or polluted fresh waters. "Tube Facts" discusses the different processes involved in the manufacture of tubing, and also shows how metallography is being applied in its manufacture. Condenser tube failures are described, numerous micrographs being shown to illustrate the corrosion of Muntz metal and tube leakage, due to imperfections in the metal. Season cracking, one of the greatest causes of condenser tube failure, is also explained. Views are presented of the company's plant and of the way in which the different manufacturing processes are carried on. The fact that the company has been in business since 1802 lends additional weight to the advantages claimed

for Scovill tubing. We are advised that engineers and others interested can obtain free copies of this publication on request. Size 5 x 7½ in. Pp. 26.

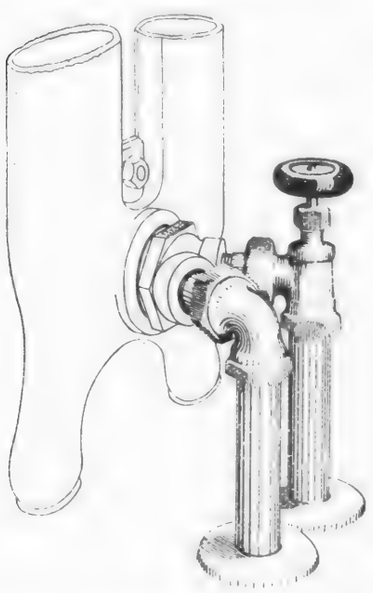
PARKER'S RADIATOR FITTING is described in recent circulars received from Parker Bros., Woburn, Mass. This fitting is intended for water heating work and as described by Mr. Parker in a letter on the subject, "in its original conception, it was more a case of development than invention. At that time, about 12 years ago, we realized that we could cut our installation costs on hot water heating work if it were possible to have the flow and return at the bottom of the same end of the radiator. Up to that time we had been using radiators tapped top and bottom of the same end. This, of course necessitated an offset in the flow connection to clear the return. The female of the species who applauded open plumbing, balked at so much open steamfitting. In a new house she is supreme. We finally induced one of the radiator manufacturers to put special bosses on the radiator and tap them especially for us. But this was expensive and caused considerable delay, so we developed the Parker radiator fitting. This makes a very neat connection and its advantages are almost self-evident." As will be seen from the accompanying illustration, the device serves to save pipe and fittings and the labor of cutting and fitting them in place, as well as insuring accuracy in roughing-in measures, as only one connection is made to the radiator. Other features are that it saves the taking up of floors and the cutting of joists, reduces the chances of damaged ceilings and eliminates all hidden air and water pockets, besides allowing the size of the radiator to be changed without any change in the piping. It is estimated that by the use of this device the frictional resistance of the entering and outgoing water is decreased, thus allowing smaller piping to be used. In operation, the hot and cold water is separated by this device and each is diverted into its proper channel by the S-shaped diaphragm. It may be installed either side up or piping connections may be reversed by bending the diaphragm to fit into the opposite set of grooves.

THE SCOVILL LABORATORY.



PARKS-CRAMER HUMIDITY REGULATOR.

CONSTRUCTION OF PARKER'S RADIATOR FITTING.



PARKER'S RADIATOR FITTING AS ATTACHED TO RADIATOR.

AUTOMATIC HUMIDITY REGULATION is discussed in Bulletin 921 of the Parks-Cramer Co., Fitchburg, Mass. The Parks-Cramer humidity regulator, is described as a rugged instrument of precision supplied with both dry and wet-bulb thermo-motive elements whose action can be adjusted to provide either a constant absolute humidity, a constant wet-bulb depression, a constant relative humidity, or a constant regain (some property of textiles which this bulletin does not thoroughly explain). While this pamphlet is devoted to the subject of textile manufacturing applications, the utility of the apparatus is apparent for other industries where similar control of humidity conditions is essential. Exterior and interior views of the regulator are shown in the bulletin. Size 6 x 8 in. Pp. 16.

Cleveland, O.—The Cleveland Heating and Piping Contractors' Association is working out a plan on apprenticeship employment and education which, it is expected, will be put into effect with the local steam fitters' organization. The working of the plan will be observed with a view of presenting it with any necessary modifications to the national heating contractors' association for adoption throughout the country.

Appointment of William G. R. Braemer as Chief Engineer of American Moistening Company.

A greater development of the air conditioning, heating and ventilating departments of the American Moistening Co., Boston, Mass., is indicated in the announcement, published in last month's issue, that William G. R. Braemer, of Philadelphia, had become chief engineer for the company, with headquarters in Boston.

W. G. R. BRAEMER

Mr. Braemer, who is well-known in the air conditioning field, is the inventor of a number of devices in connection with air washing, humidifying, dehumidifying, cooling and drying systems. He was for nine years in charge of this branch of the business of Warren Webster & Company, in Camden, and for the past three and a half years has acted as consulting engineer, specializing in air conditioning.

Mr. Braemer is a graduate of the College of Technology of Copenhagen, and is a practical mechanic. Previous to his work in organizing and conducting the air conditioning department of Warren Webster & Company, he was for over nine years chief engineer for the Buffalo Forge Company. He thus brings to his new connection a wide experience gained in professional work in humidification.

He is a member of the American Society of Mechanical Engineers and of the American Society of Heating and Ventilating Engineers, being at present chairman of the society's Committee on Legislation. He was one of the principal organizers of the Philadelphia Ventilation Commission.

Hoffman Specialty Company Takes Over Haynes Modulating Valve.

As announced last month, Charles V. Haynes, formerly with the Haynes Selling Company, Philadelphia, has become associated with the Hoffman Specialty Company as vice-president and general sales manager. In joining the Hoffman organization Mr. Haynes brings with him the Haynes modulating valve which, coupled with the Hoffman line of valves, gives the company a complete combination of specialties for vapor and vacuum heating systems.

The Haynes Selling Company, a partnership, has been dissolved, Mr. Haynes retiring and a new company incorporated under the laws of Pennsylvania, which will be known as the Haynes Selling Co., Inc. The officers of the new corporation are former associates of Mr. Haynes. The president is C. W. Stewart; vice-president, R. E. Jones; treasurer, Elkan Henley; and secretary, M. F. Blankin. The new company will occupy the same offices at 1711 Sansom Street and will continue the same sales policy as its predecessor.

What Ails Us?

The Good Old Days

Buggy rides
5c cigars
Whiskers
$10 suits
Boots
Real blondes
10c shares
Bustles
Tintypes
Corsets
Side saddles
Nickel car rides
2c R. R .fares
Foot dancing
Dollar watches
Town pump
Kerosene lamps
Pants patches
2-piece bathing suits
Coal to burn
Celluloid collars
$1-a-day hotels
Natural complexions
Home-made bread
Starched collars
Cotton stockings
Mustache cups
Large families
Longhand letters
Crayon portraits

The Present Days.

Movies
Jitneys
Jazz bands
50c haircuts
Two-bit shaves
Silk shirts
Low necks
Bolshevists
High rents
Coal shortage
Skirt shortage
Silk hose
The shimmy
Wrist watches
6-cent fares
$100 suits
Cafeterias
6-hour days
$18 shoes
Jamaica ginger
Teddy bears
Manicures
Golf
Plucked eyebrows
Joy riding
Tight skirts
Bridge whist
Skyscrapers
I. W. W.'s
Divorces

—First National Bank, South Boston, Va.

Paul Harold Berggreen Permanently Located in America.

Paul Harold Berggreen, of Copenhagen, Denmark, who has been in this country during the past year representing the Reck Heating Company of Copenhagen in the demonstration of the new type of smokeless boiler designed by Captain A. B. Reck, head of that company, has announced his association with Henry I. McConnell, in the partnership of Berggreen & McConnell, Pittsburgh, Pa. The new firm will act as industrial engineers, specializing in valuation and examination of industrial plants and engineering enterprises. Quarters have been taken at 604 Oliver Building, Pittsburgh.

The Main Office of the McAlear Mfg. Company

Attention is directed to the address of the McAlear Mfg. Company, manufacturer of the McAlear line of heating specialties for vacuum and vapor heating, high and low pressures, which is 1901-7 So. Western Avenue, Chicago, Ill. Through an inadvertence the former address of this company was inserted in the firm's advertisement which appeared in THE HEATING AND VENTILATING MAGAZINE for January.

Deaths.

HARRY B. PERRIGO, of New Haven, Conn., formerly with the heating and plumbing supply house of C. S. Mersick & Co., and at the time of his death president of Perrigo, Inc., a supply house which he established last April, was among those who lost their lives in the fire that destroyed the Rialto Theatre in New Haven recently. He was 48 years old. Mr. Perrigo was known as a writer on heating subjects.

EDWARD S. BERRY, who was president of the Philadelphia Chapter of the American Society of Heating and Ventilating Engineers at the time of the society's meeting in that city last year and who was at the head of the welcoming committee, died December 9 following an operation for appendicitis. Mr. Berry was nearly 48 years old. He was formerly superintendent of the warm-air department of the Kelsey Heating Company, in Syracuse, remaining with that company from 1898 to 1904. He then went to Philadelphia to take the position of superintendent of the warm-air heating department of the James Spear Stove and Heating Company. At the time of his death Mr. Berry was president of the company.

JAMES M. HEALY, formerly of the heating and plumbing firm of Healy & O'Brien, Indianapolis, Ind., and at one time a member of the board of directors of the Heating and Piping Contractors' National Association, died at his home in Indianapolis, December 24. He was 62 years old. He retired from the business about six years ago to become superintendent of buildings and construction for the Indianapolis School Board.

ANNOUNCING

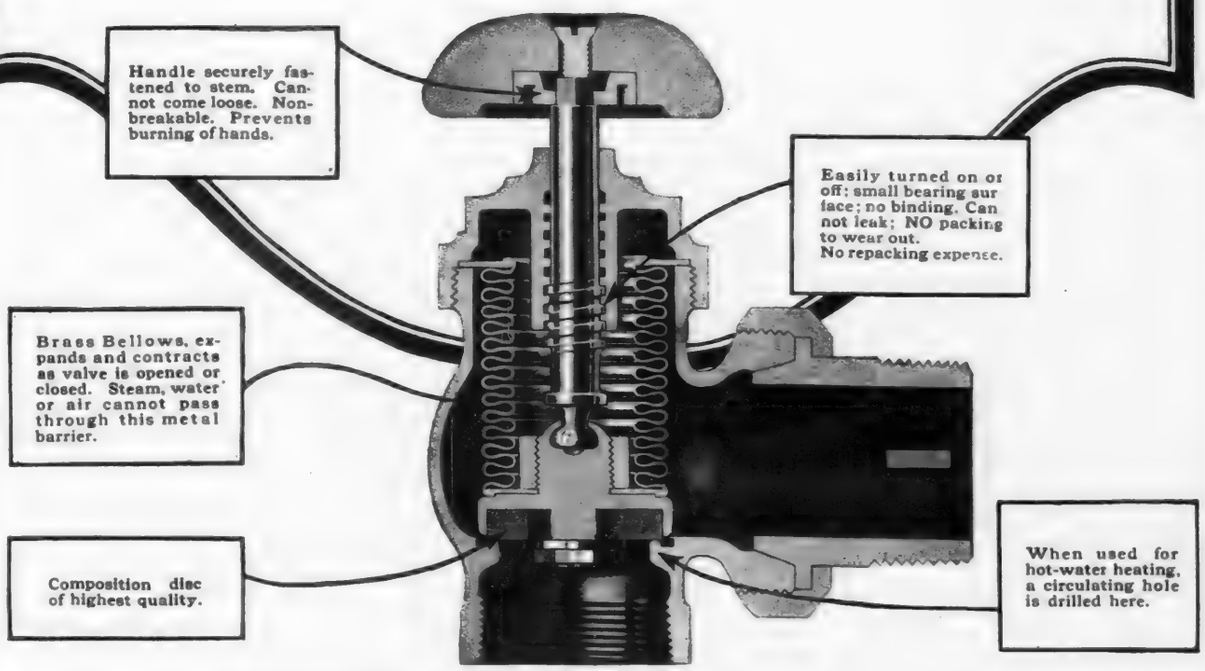
The new Ideal Packless Valve

RADIATOR HEATING — with its surroundings of refinement — has waited long for a suitable, appropriate Supply Valve *that would not leak steam, water or air.*

A refined Radiator valve—dependable, without packing, of attractive design and moderately priced—is assured an immediate welcome by a long-suffering public.

The new Ideal Packless Valve (designed by our engineers and using a bellows of our own manufacture) represents our idea of a perfect combination of all the essentials of efficient service in an appropriate design.

We recommend this valve as worthy of your specification.

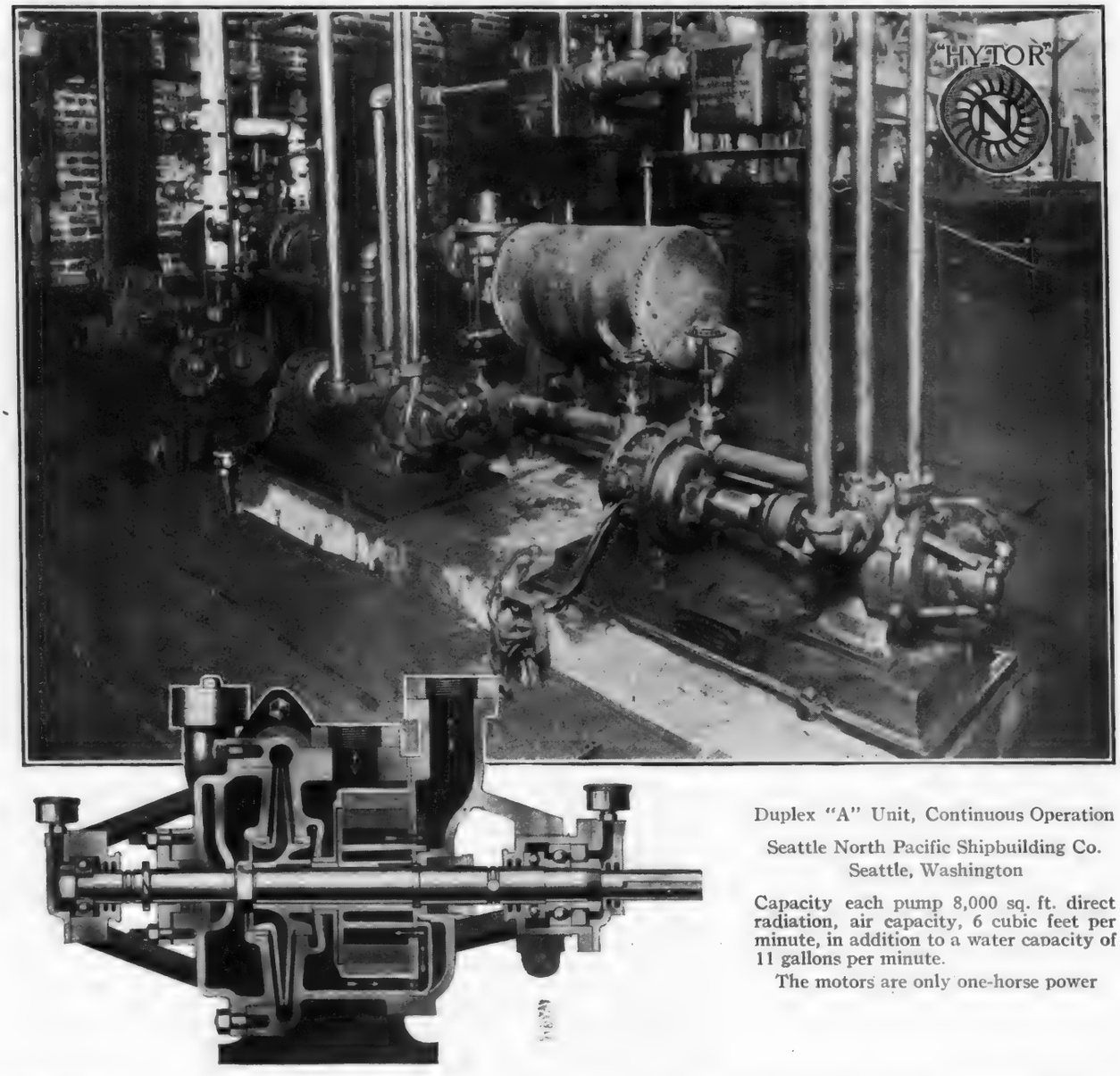

Handle securely fastened to stem. Cannot come loose. Nonbreakable. Prevents burning of hands.
Easily turned on or off; small bearing surface; no binding. Can not leak; NO packing to wear out. No repacking expense.
Brass Bellows, expands and contracts as valve is opened or closed. Steam, water or air cannot pass through this metal barrier.
Composition disc of highest quality.
When used for hot-water heating, a circulating hole is drilled here.

AMERICAN RADIATOR COMPANY

AMERICAN Radiators and IDEAL Boilers for every heating need

104 West 42nd Street, New York Dept. 106 816 So. Michigan Ave., Chicago

EFFICIENT HEATING *demands the* JENNINGS PUMP



Duplex "A" Unit, Continuous Operation

Seattle North Pacific Shipbuilding Co.
Seattle, Washington

Capacity each pump 8,000 sq. ft. direct radiation, air capacity, 6 cubic feet per minute, in addition to a water capacity of 11 gallons per minute.

The motors are only one-horse power

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs, Bulletin No. 15 gives them in detail. Write for it.

The NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

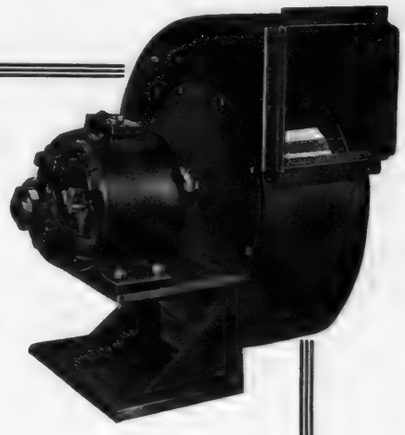
Miscellaneous Notes.

Cleveland, O.—Postponement of the opening date of the American Building Exposition, Cleveland, from February 22 to a date in April, probably not later than the 18th, is announced by reason of the insistence of Mayor Kohler that the new city auditorium be complete to the last detail before it is formally accepted by the city and offered for exhibition purposes. The exposition is to be the first public attraction in the new building.

Chamber of Commerce of the United States, through John Ihdler, manager of the Civic Development Department, is authority for the statement that the housing shortage in this country will not be overcome within the next five years. Mr. Ihdler said that even the well-to-do would not be as adequately provided with good housing in 1927 as they were in 1914. Speaking of building costs, Mr. Ihdler said that "so far as experience goes, such short cuts to the milennium as government building and management do not promise to reduce real costs."

Building Operations for December, 1921, in the 27 northeastern States, as reported by the F. W. Dodge Company, amounted to more than for any previous December, with the exception of December, 1919. The total amount of these contracts was $198,518,000, an increase of 3% over the November figure, whereas December usually shows a decline from November. The increase was 98% over the corresponding month of 1920. "Every present indication," states the report, "is that 1922 will see a measurably larger volume of construction than the program carried through in 1921." December building contracts in New England totaled $26,474,000, an increase of 44% over November. In New York State and northern New Jersey the figures were $62,331,000, the largest December total on record in this district and 6% greater than November. In the middle Atlantic States the total came to $32,923,000, an increase of 9% over the November figures. The Pittsburgh district made the poorest showing with $22,453,000, a decrease of 35% from the November total, but an increase of 14% over the total for December 1920. In the central West, the total came to $45,985,000, an increase of 1% over November, and in the northwest the figures, $8,443,000, represented an increase of 80% over November and 75% over December, 1920.

New York.—A point in connection with the new income tax law has been brought out by Seidman and Seidman, certified public accountants, New York, which may mean the saving of large sums to American business men. To take advantage of the situation, all claims will have to be submitted to the government before March 15, 1922. The point refers to Section 234, subsection S of the Fordney act, and provides, in effect, that any concern that installed new equipment to produce articles contributing to the prosecution of the war will be allowed to deduct from its income tax the difference between the cost of that equipment and its value after the war. This far-reaching provision, it is stated, has been part of the Federal taxation law since 1918. Until now, however, very few have taken advantage of it, because it could not take effect until the official end of the war which did not take place until July, 1921.



There is an Autovent Fan or Uniblade Blower for Every Ventilating, Drying, Heating or Exhausting Application

For any job, big or little, we have a Uniblade Blower or Autovent Fan to meet the existing conditions. They are built in a variety of sizes, designs and speeds, either D. C. or A. C. motors.

PATENTED

Only the best possible material is used in their construction and every effort is made to eliminate extra wearing parts, to give thorough lubrication, and the delivery of the maximum amount of air at the lowest operating cost—in short, to insure the greatest possible economy to the user.

Ask for our latest catalog—it will tell you all the details

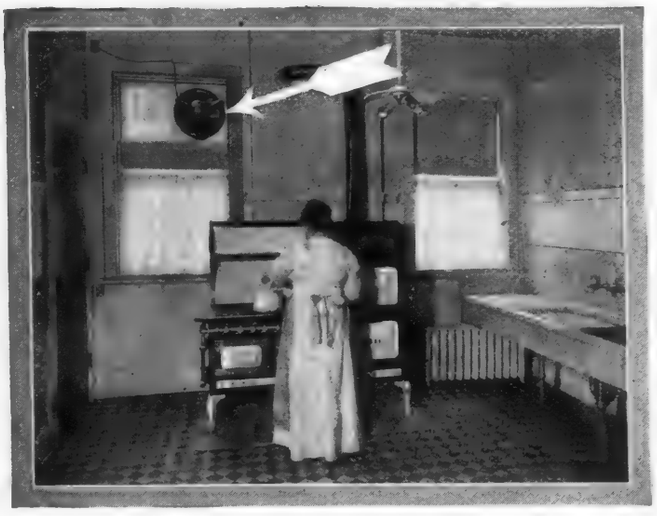
AUTOVENT FAN & BLOWER CO.
FORMERLY
BATTERMAN-TRUITT CO.
Branch Offices in Principal Cities
General Offices and Works, 730-738 W. Monroe St., Chicago

Bureau of Mines announces that underground ventilation studies have been made by B. O. Pickard, district engineer, and E. D. Gardner, in the mines of Amador, Calaveras and Nevada Counties in California, and reports are under way. The report will deal with dust, high temperatures and humidities, accompanied in each case by remedial suggestions. The work is being continued.

Washington, D. C.—The Research Information Council of the National Research Council announces that it is prepared to supply to those interested information about scientific instruments, apparatus and supplies, laboratory construction and equipment. Requests should be addressed to National Research Council, Information Service, Washington, D. C.

American Engineering Standards Committee announces that the Secretary of War has directed that "the supply branches of the army utilize in connection with their specifications the standards that have been or may be adopted by the American Engineering Standards Committee." This applies to all seven supply branches of the army, including the Quartermaster Corps, which purchases all general supplies of a commercial character; Ordnance Department, Medical Department, Corps of Engineers, Signal Corps, Chemical Warfare Corps and Air Service.

Washington, D. C.—The greatest building activity in this country this year will be in the industrial States, says a forecast of the building outlook made by the Committee on Statistics and Standards of the Chamber of Commerce of the United States. A large number of the operations, it is added, will be in the shape of alterations and enlargements. According to the committee, California leads the other States with respect to probable construction, while good likelihoods of construction lie in the central west and in the east. The prospects for building in the agricultural States, it is added, are not so favorable. Regarding the items of material, labor and funds, it is stated that the prices of materials, on the whole, are much the most favorable of the three factors. Lower labor costs, it is inferred, will come in the spring, leaving the matter of obtaining money for construction the most difficult problem of all.



Three times a day---during morning, noon, and evening cooking periods---21 times a week or over a thousand times a year an

ILG ELECTRIC VENTILATING COMPANY ILGAIR CHICAGO, ILL.

Kitchen Ventilator will keep cooking odors and greasy fumes from circulating through every room.

The Ilgair is the most useful of Household Appliances. It costs less despite the fact that it is used the most. Send for descriptive circular, also literature on Ilg Self Cooled Motor Fans for other uses.

With the closing of windows and doors during cold weather "Ventilation through the Kitchen" will be eagerly sought by every home owner. Contractors can sell many Ilgairs right now.

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS RESTAURANTS · THEATRES · HOUSES · ETC.

ILG ELECTRIC VENTILATING CO., 2858 NORTH CRAWFORD AVENUE, CHICAGO, ILL.

MARSH
RE-ENFORCED PACKLESS
VALVES
Quick Opening
Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialise on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., Erie, Pa.

TRADE JENKINS MARK Jenkins Bros

Merit tempts imitation

Jenkins Valves are made only by Jenkins Bros. and have the Jenkins Diamond and signature cast on the body—a valve without this identification is not a genuine "Jenkins."

Valves in types and sizes for all requirements of plumbing, heating, and power plant. At supply houses everywhere.

"Jenkins service can only be expected from genuine Jenkins Valves"

JENKINS BROS.

New York Boston Philadelphia Chicago
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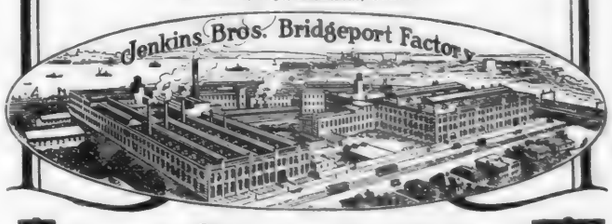
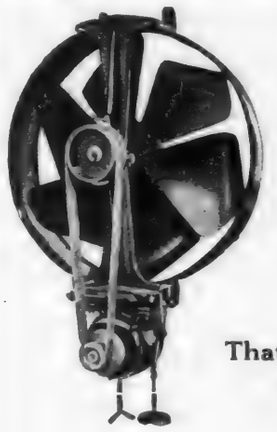
FACTORIES: Bridgeport, Conn.: Elizabeth, N.J.; Montreal, Canada.



Jenkins Valves
SINCE 1864



A Variable Speed

Disc Fan

A Better Fan at a Lower Price

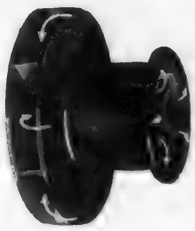
That's what you get if you purchase

THE

Bayley

JUNIOR

DISC FAN



The Fan with variable speed control and a constant speed motor. No rheostat, or troublesome brush shifting device. Simply vary the belt tension to vary speed from 2½ to 100% of full speed. A plain, highly efficient, common sense fan that is as near trouble proof as a fan can be.

PATENTED VENTILATED PULLEY

with a cooling draft of air passing through the core prevents heating or burning of belt. Acid proof belt guaranteed for one year. ***Send for Bulletin today.***

BAYLEY MFG. CO.,

Dept. E, Milwaukee, Wis.

Dwight P. Robinson & Co., New York, reports that it has secured important contracts from the Duquesne Light Co., of Pittsburgh, and from the New Orleans Railway and Light Company. The work for the Duquesne Light Company includes the installation of a second unit of 60,000 K. W. at the Colfax power station, together with three additional substations along the company's lines in the Pittsburgh district. The company reports impending construction activity among public utilities generally.

Pittsburgh, Pa.—The report of the investigation made by the Bureau of Mines at the Pittsburgh station, relating to the value of coke, anthracite and bituminous coal for the generation of steam in low-pressure cast-iron boilers, is being prepared for publication. The report shows the relative steaming values of the fuels and why the thermal efficiency varies with the different fuels. The draft required with the various fuels is carefully analyzed.

Frank Kiernan & Co., advertising agency, 135 Broadway, New York, has opened a business paper department, under the personal direction of Alfred N. Williams, who has had a long experience in trade paper and advertising agency work.

Daniel L. Hanson, special field representative of the National Trade Extension Bureau, Evansville, Ind., has severed his connection with the bureau to open an office in Boston as manufacturers' sales agent.

Associated Technical Societies of Detroit has been organized, being composed of the architectural, engineering and other technical societies of Detroit. Among the organizations included in the affiliation is the Michigan Chapter of the American Society of Heating and Ventilating Engineers. It is proposed to have one meeting each month of the Associated Technical Societies, this meeting to be under the management of one of the member societies. The officers for 1922 are: Chairman, P. W. Keating; vice-chairman, A. A. Mayer; secretary-treasurer, Walter R. Meier.

American Metric Association held its annual meeting in Toronto, December 21, 1921. Among the speakers were Theodore H. Miller, works manager of the De Laval Separator Company, who told of the advantages that had been gained through the company's change to the metric system in 1910 throughout its plant.

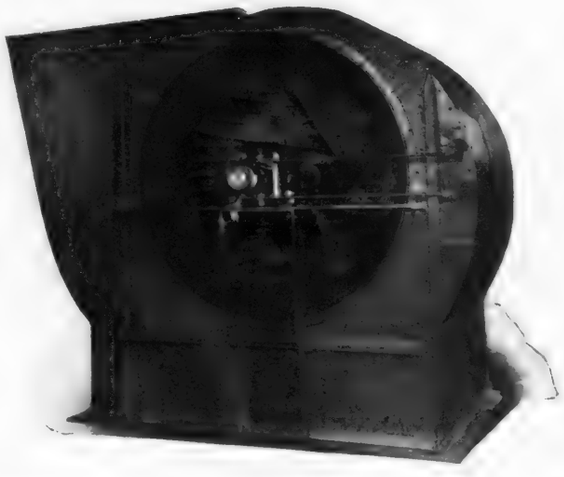
Buffalo, N. Y.—Announcement is made that the Engineering Society of Buffalo, with a membership of 600, now has permanent quarters in the Iroquois Hotel, Buffalo, which have been fitted up as a club.

National Safety Council is taking a census to find out how many safety workers there are, who they are and where located. The results of the census will show, among other things, how the construction industry compares with the other industries in this respect. Those engaged in industrial or public accident prevention or industrial health work are urged to send to the National Safety Council, 168 North Michigan Avenue, Chicago, their names and other data applying to the census.

Philadelphia Steam Heating and Engineering Co., Philadelphia, Pa., has prepared plans for a new two-story building, 60 x 120 ft. at 3316-2320 Lancaster Avenue, to cost $60,000.

Cleveland Heating and Piping Contractors' Association elected the following officers at its recent annual meeting: President, F. M. Daugherty, Grinnell Co.; vice-president, M. L. Crowell, Crowell & Smith Co.; secretary, Charles Mallett, Schneider Plumbing Co.; treasurer, A. E. Welker, Price & Welker Co. Executive committee: Walter Klie, Smith & Oby Co.; William Clarke, Becker-Seidel Co.; E. D. Maurer, Maurer Bros. Co.; M. Jones; and W. B. Van Sickle. Retiring President Klie was presented with a silver fruit dish in appreciation of his services.

Chicago, Ill.—The city council committee on health has requested Dr. J. M. Murphy, in charge of the cold flats comp'aints, to draft an ordinance fixing the following degrees of heat in apartments and flats: 60° F. at 6:30 A. M., 65° at 8:30 A. M., and 68° thereafter until 10:30 P. M. No provision for heat between 10:30 P. M. and 6:30 A. M. was recommended.



May we have the pleasure of sending you a copy of our new catalogue?

LEHIGH

Multiblade Fans

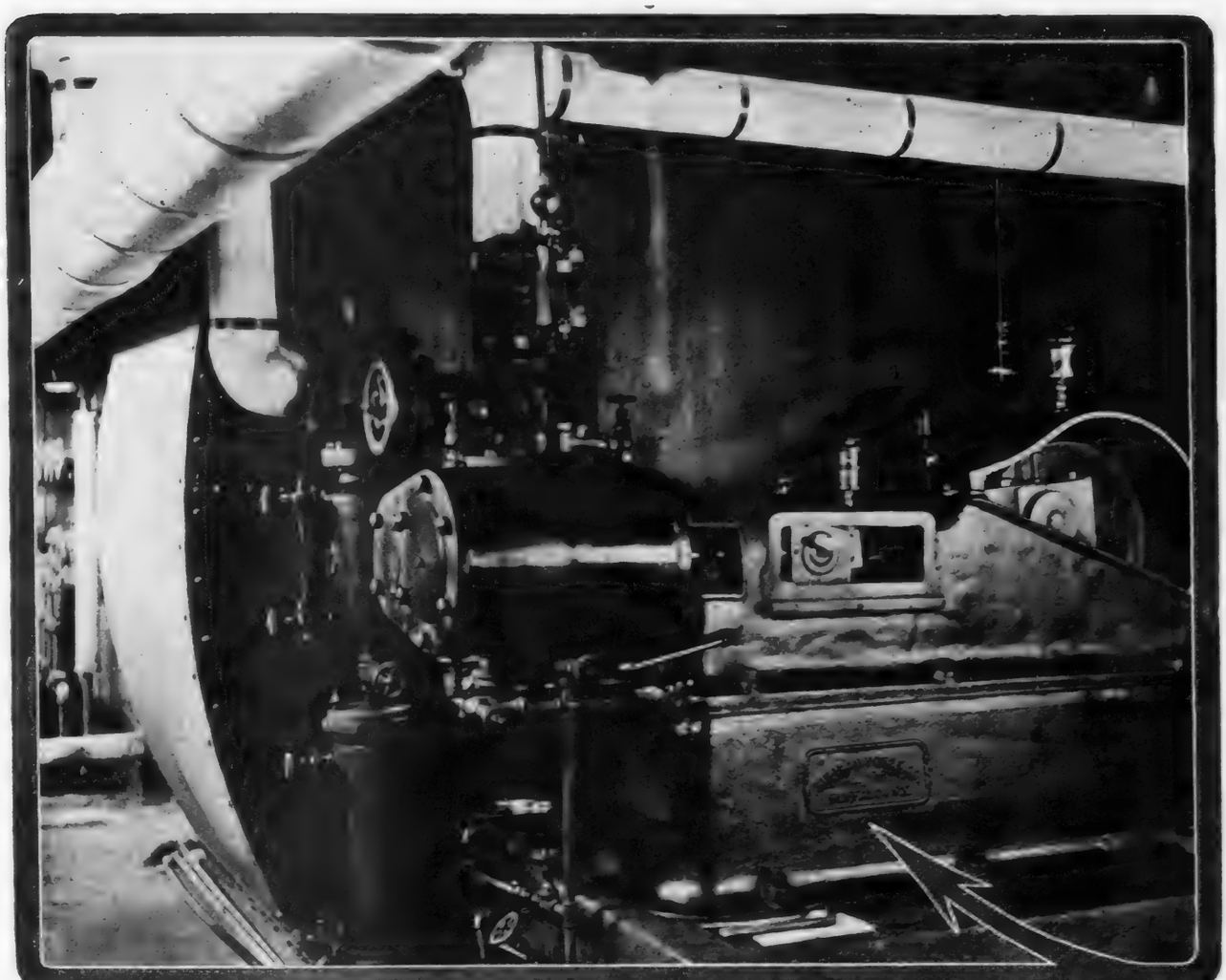
The efficiency and durability of Lehigh Fans makes possible their enviable reputation.

The special construction of the Lehigh Multiblade Wheel combines in one the desirable qualities of the older steel plate fan with large capacity and efficient operation of the newer Multiblade Wheel.

No stay rods are employed to keep it in shape, no matter what the speed. Strength and rigidity of the wheel is secured by special blades which run tangent from the cast iron hub to the periphery.

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.



19 YEARS SERVICE

The drying of crayons is one that calls the for highest efficiency of the mechanical equipment.

The American Crayon Company have kept the "Old Faithful" brand of crayons and chalks at the front of the field since 1835.

We point with pride to the Buffalo Fan and engine that has typified "Old Faithful" by its nineteen years of continuous and satisfactory service at the American Crayon Company. This is summed up by a recent report which states

"We like it because it gives good service."

A line to Dept. 36 will bring further evidences of Buffalo Service.

Buffalo Forge Company
Buffalo, N. Y.

"Buffalo"

Manufacturers' Notes.

Fitzgibbons Boiler Co., Inc., Oswego, N. Y., announces the opening of new and more commodious quarters in New York City at 47 West 42nd Street, with James D. Erskine in charge of the office, sales and service organization. The boiler and manufacturing plant in Oswego continues under the old plant management, with modernized equipment and increased facilities. David Fitzgibbons, vice-president, has charge of manufacturing. The Fitzgibbons Boiler Company was established nearly 40 years ago and the company's plant has been in continuous operation since that time. The company reports encouraging future sales possibilities based on the number and character of recent orders. As was announced in the January issue, the Fitzgibbons Boiler Company's entire business was recently purchased by Homer Addams, eastern manager of the Kewanee Boiler Company.

Kelly & Jones, Pittsburgh, Pa., will build a pipe warehouse in Chicago, on property recently purchased at Fifteenth Street and Western Avenue. The property already has a two-story structure on it which will be used as a branch office and showroom. The company's Chicago office, now located in the Ashland block, will be transferred about March 1 to Fifteenth Street and Western Avenue.

Ruby Boiler & Radiator Co., New York, has moved its offices to 431 West 42nd Street.

Haynes-Langenberg Mfg. Co., St. Louis, Mo., has awarded the contract for the reconstruction of its plant which was partially destroyed by fire. The new structure will cost $125,000.

Wilson Welder & Metals Co., New York, has moved its general offices and Bush Terminal factory in Brooklyn to 132 King Street, New York. The company manufacturers Wilson plastic-arc metals which are sold in packages of ten 5-lb. units, enabling a welder to take to his job just the quantity of metal required. The company also announces that it maintains a completely-equipped demonstration room where the Wilson plastic-arc system is shown, the company stating that this is the one which was used so effectively to repair the intentionally-damaged interned German ships. Claude Hartford, formerly with the engineering department of the New York Steam Company, is general sales manager for the company.

Titusville Iron Works Co., Titusville, Pa., announces the appointment of M. A. Cordner as New York sales manager in charge of the company's New York office at 90 West Street.

General Boilers Co., Waukegan, Ill., it is announced, has purchased the business of the Eureka Smokeless Furnace Company, of Chicago.

Kennedy Valve Mfg. Co., Elmira, N. Y., announces the following changes in its organization: H. D. Kane, appointed assistant to C. A. Burgess as traveling representative, with headquarters in Elmira; James P. Murphy, appointed assistant to S. C. Mead, Chicago branch manager; and John J. Milliken, formerly of the Chicago office, appointed assistant to E. H. Koons, eastern sales manager. An additional sales office has been opened in Seattle, Wash., in the L. C. Smith Building.

Carrier Engineering Corporation, Newark, N. J., has organized the Carrier Construction Company, at the same address, to operate as sheet metal artisans, specializing in the Carrier standard diffuser outlets.

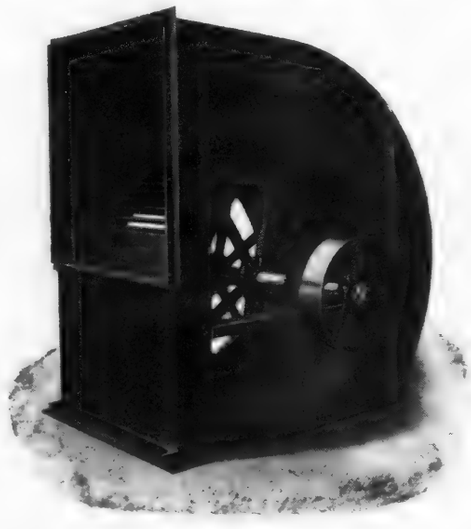
Johns-Manville, Inc., New York, known as the largest producers of asbestos products in the world, has notified its deserving employees, whose salaries were reduced 10% October 1, 1921, that their former salaries would be resumed as of January 1, 1922, "This action has been taken," says the statement authorized by the board of directors, "in the belief that the tide of business conditions has changed and is turning for the better."

Central Station Heating Notes.

Duluth, Minn.—The central heating plant ordinance proposed by the Duluth Central Heating Company has been redrafted and the provision incorporated that the city will be privileged to take over the plant at end of ten years. Officers of the company urged a 15-year limit, while the city proposed a 5-year limit. The new ordinance provides that at the time of construction a detailed statement of the cost of the plant must be filed with the city. The going values, good-will of the plant and other matters

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



CORRECT DESIGN, HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

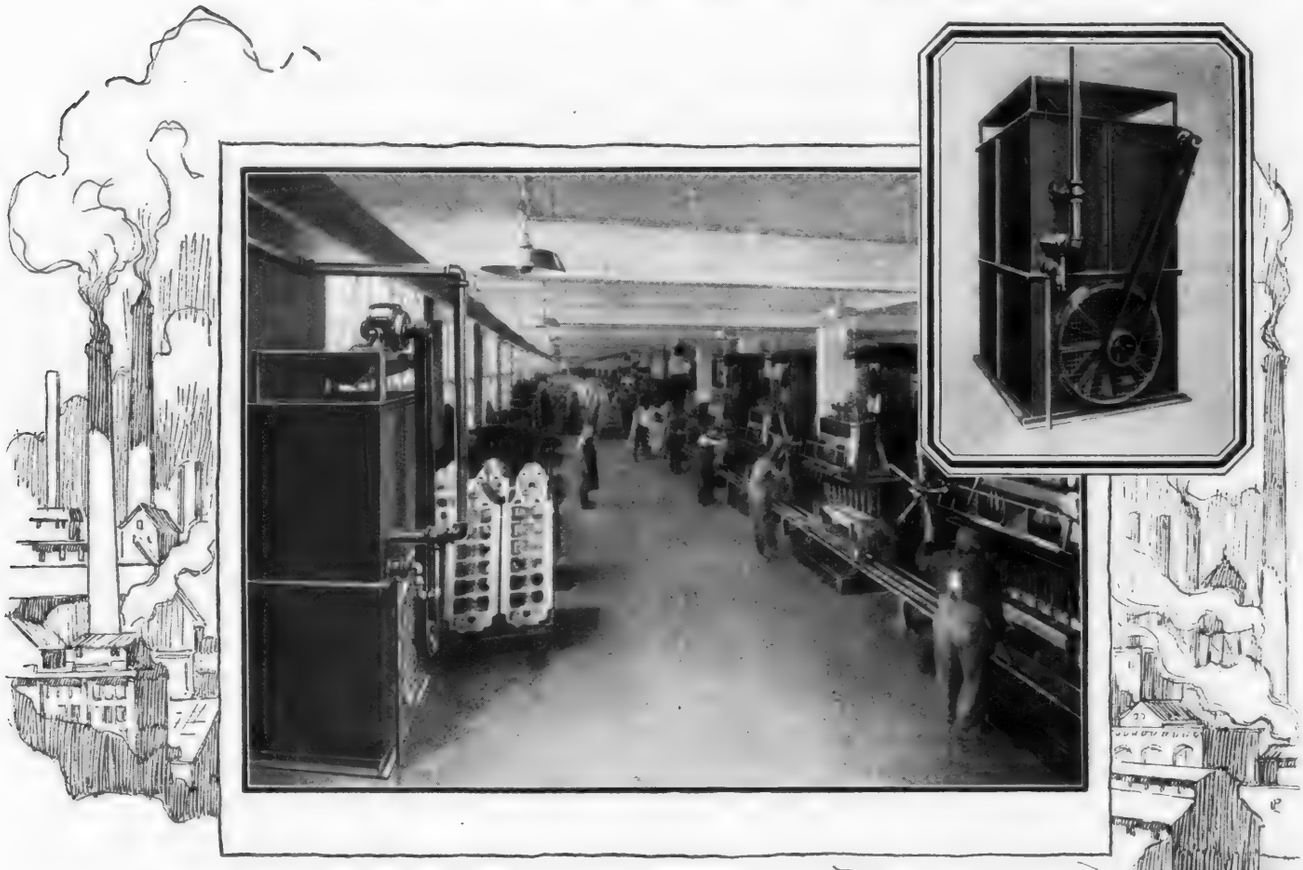
THIS DEPARTMENT IS FREE TO YOU

We also manufacture a complete line of Disc, Cone and Steel Plate Fans:

Write Department D

BUCKEYE BLOWER CO.

COLUMBUS, OHIO



Uniform Heat—and Wherever You Want It

Built without overhead air distributing ducts, the "Sirocco" A B C Portable Heating Unit can be installed anywhere, and is particularly adapted to the heating of factories, machine shops, foundries, garages, paper mills, wood-working shops, texile mills, warehouses and industrial buildings generally.

The cool air which is always near the floor, is forced through the heated coils, of the "Sirocco" A B C Unit and warmed. It then circulates throughout the room to maintain comfortable and healthful working conditions.

Write for Latest Booklet

"Sirocco" A B C Portable Heating Units are completely described in our Bulletin No. 17, Series 9, just off the press. If you have a heating problem for a new building, or an addition to a plant, you will find valuable and useful information in this booklet. Write today for your copy.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

(16)

"Sirocco" Products

BLOWERS · EXHAUSTERS · VENTILATING FANS · AIR WASHERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

that have caused arguments and disagreements in taking over other utilities, the proposal infers, will be eliminated.

Bucyrus, O.—The city council has unanimously adopted the rate ordinance of the water heating system to be installed by the Ohio Power Company. The provisions of the ordinance were published in these columns last month.

Cleveland, O.—Steam heating service must be abandoned entirely by the city of Cleveland or the Fairmount system, supplying service in the Euclid Avenue East 105th Street District must be completely rehabilitated, according to a statement made by W. E. Davis, city commissioner of light and heat. It is estimated that it will cost $200,000 to install proper distributing mains. The plant now represents an investment of $262,000. It was established during the mayorship of Newton D. Baker, in connection with the Fairmount pumping station of the city's waterworks, being originally conceived to prevent the erection of a boiler house in Wade Park to supply the Art Museum. The boiler plant was later built and the Art Museum is no longer a customer of the city plant. There is a 10-in. main leading to the museum from the main lines three-quarters of a mile away, which, it is stated, is no longer of use. Commissioner Davis maintains that the plant has never made money and never will. "In places," he states, "the mains are protected only by a canvas covering which is in a state of disrepair causing considerable losses in the distribution system." The Fairmount station supplies 205 customers. The original rate of 25 cents per 1000 lbs. of condensation for steam heat was raised to 75 cents.

Bloomington, Ill.—The Bloomington and Normal Railway and Light Company has petitioned the Illinois Commerce Commission for permission to discontinue its water heating service in Bloomington. That such a move was contemplated was brought out in the hearings held recently with respect to fixing the rate for steam heat service which was later allowed. There are over 100 customers of the service in the city. It is understood that the company plans to substitute steam heat for those customers who have heretofore had the water heating service and this will probably necessitate the changing of mains on some of the uptown streets.

New Incorporations.

Wm. H. Jones Co., 426 Plymouth St., Chicago, Ill., capital $15,000, to engage in general heating and ventilating and plumbing business. Incorporators: James E. Brennan, Robert H. DuBoise and William J. Price. Correspondent, Maddock, Jaffe & Green, 39 South La Salle St., Chicago.

E. T. Keefe Co., Boston, Mass., capital $50,000, incorporated to take over the heating and ventilating business of E. T. Keefe, at 48 Kirkland Street, Boston. Incorporators: Edmund T. Keefe, Brookline; Harold W. Fleming, Waltham; and Richard C. Keefe, Framingham.

Superior Fuel Oil Saver Co., Springfield, Mass., capital $50,000, to manufacture heating specialties. Incorporators: Charles F. Randall, Joseph T. Clark and James T. Smith, all of Springfield.

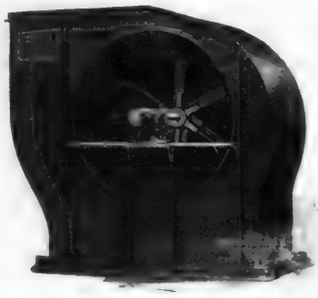
Domestic Dehydrator Corporation, 489 Fifth Avenue, New York, capital $750,000 perferred of $100 par value and 18,000 shares of common stock of no par value, to manufacture "De-hyd-rite" machines. President, J. B. Short; vice-president, G. B. McComb; treasurer, A. B. Meserlin; secretary, R. J. Short. Among the directors is Frederick Will, Sr., president of the Sill Stove Works, Rochester, N. Y.

Business Changes.

Koalsave Vacuum Valve Co., 101 Park Ave., New York, of which Hugh M. Smith was president and treasurer, has been purchased by David A. Mount. The company's quarters will be maintained at the same address.

General Heating and Ventilation Co., Milwaukee, Wis., has filed a petition in bankruptcy. This firm had the contract for the heating and ventilating work on the new Ottumwa (Ia.) High School building. The company was bonded on this work by the Maryland Casualty Co., of Baltimore.

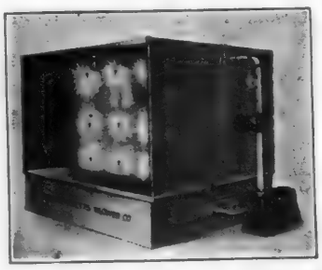
MASSACHUSETTS



"Squirrel Cage" Fans

MASSACHUSETTS

Air Washers



Installed in many of the largest buildings throughout the country are giving complete satisfaction.

We manufacture Complete Heating Systems, Fans for all purposes, Complete Drying systems for paper, lumber, wool, leather, etc. Dust Removal and Conveying systems, Forced Draft Apparatus.

MASSACHUSETTS BLOWER COMPANY
WATERTOWN, MASS.
Sales Offices in Principal Cities

WING-SCRUPLEX UNIT HEATER
REG. U.S. PAT. OFF.

A simple, portable, self-contained heating and ventilating unit, consisting of an efficient heating element encased in substantial housing through which air is drawn by a powerful **Wing-Scruplex** (Screw-propeller) **Fan** and discharged horizontally through a distributing nozzle of proper design to meet the conditions of installation. Accompanying photo shows floor (steam) type heater with one style of distributing diffuser.

The **Wing-Scruplex Unit Heater System** of **Heating** any Mill, Factory, Foundry, Garage, etc., costs less to install and is more economical in operating expense than any other method of warming and is also more efficient, as it insures a thorough distribution of heated air at the working level without the aid of large, expensive distributing pipes and ducts.

Wing-Scruplex Unit Heaters save coal because they do not heat or overheat overhead or dead space. They direct the heated air where it is needed.

Built in several sizes, in Floor, Ceiling and Wall Types, Steam or Direct-fired, completely assembled before shipment.

Write for our Engineers' Data Book!

L. J. Wing Mfg. Co.

Fans and Blowers (all types)
Damper Regulators Small Turbines
HUDSON and 13th STREETS, NEW YORK CITY

Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

Starrett & Van Veck Architects TRADING FLOOR, NEW YORK CURB MARKET *Photo by Underwood & Underwood*

The New York Curb Market Brings Fresh Air Indoors

THE New York Curb has deserted the frenzied pavement of Broad Street for a warm, dry and handsome new building on Trinity Place. The busy brokers will still have the freedom and exhilaration of the outdoors because

Sturtevant Equipment

was chosen to provide complete ventilation along modern approved scientific lines. The long list of important buildings in which you find Sturtevant apparatus is the best evidence of the satisfactory service that Sturtevant methods produce. Our branch offices in twenty-four cities have qualified engineers to discuss heating and ventilating problems with you. We invite the opportunity of considering plans at an early stage of development so that our wide experience on this technical subject may be freely drawn upon.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

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The Relationship Between Architect and Engineer.

A discussion that has been going on in Seattle, Wash., as to whether or not the new stadium for the University of Washington is essentially an engineering, rather than an architectural problem, has revived the question of the relationship between architects and engineers. In taking up the cudgels for the architects, Charles H. Bebb, of Bebb, and Gould, Seattle, make the following point:

"The logical basis of reasoning from the engineer's standpoint can only be that the physical properties of the building are more vitally the prime factors than the purposes and conception of the building as a whole. That the expert knowledge of the bearing values of the soil, the properties of reinforced concrete, the strength of columns, girders and joists, etc., are the primary points to be considered, and that the planning and design are secondary considerations requiring reluctantly the collaboration of the architect. This argument would hold good, were it a fact, for every kind and class of building erected by human hands from the mighty Woolworth building in New York to the simplest structure erected in space, for in none can we neglect at least a modicum of engineering knowledge."

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Sales Opportunity.—Excellent opportunity for a high-grade sales organization or man with business and sales experience to acquire control of a profitable and going business, involving the assembly and distribution of a high-grade line of gas steam radiation. The right man or organization can be assured of productive and sales coöperation and financial assistance. Must be able to invest from $10,000 to $20,000 to guarantee good faith and to be assured of control. Business located in western New York, but can be operated from any point. Applications will only be considered from those having qualifications as outlined above. State particulars in detail first letter. Box 29, HEATING AND VENTILATING MAGAZINE.

Wanted—Salesmen to handle, as side line or otherwise, patented heating system on commission. Well established. Apply letter to Box 30, care of Heating and Ventilating Magazine.

Sales Representatives Wanted.—The Stark Sheet Metal Works Company, 418 Second Street, S. E., Canton, O., desires to get in touch with established sales representatives having clientele among architects, engineers and sheet-metal contractors in New York City, Boston and Philadelphia, to further the sales of Perfecto damper regulators, and Air-o-matic and Mack Ejector Ventilators.

Position Wanted—By young engineer, 30 years old. Five years' experience in heating and ventilating work in the design and installation of air conditioning, drying and heating systems, also general maintenance work in engineering department of large industrial concern. Address Raymond, care of Heating and Ventilating Magazine.

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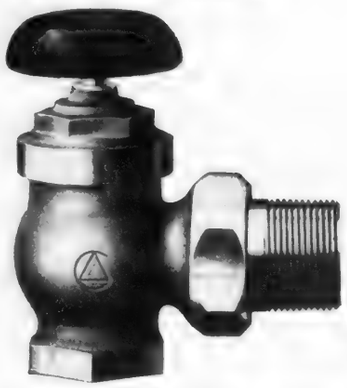
a new and more pleasing line of Packless Radiator Valves

"Genuine Detroit"

PACKLESS RADIATOR VALVE
Bellows Type



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Stocked by leading jobbers

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STANDARD THERMOMETERS and TEMPERATURE ALARMS

DISTINCTLY HIGH GRADE IN EVERY RESPECT

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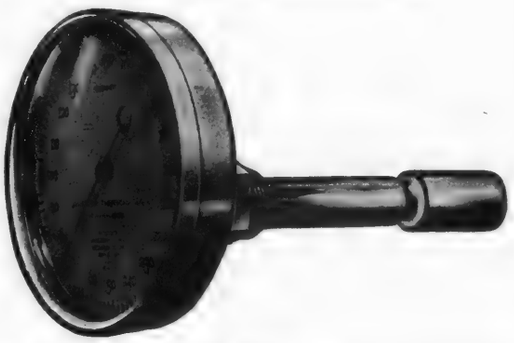

STANDARD *"Metallic"* THERMOMETERS

are made in Indicating or Recording type, either angle or straight stem, for all general purposes. Their durability an outstanding feature. Get descriptive booklet. Locate your requirements, then specify STANDARD *"Metallic"* where quality is a factor.

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Standard with STEAM USERS SINCE '94

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BUILT RIGHT RUN RIGHT

The New York Blower Co.

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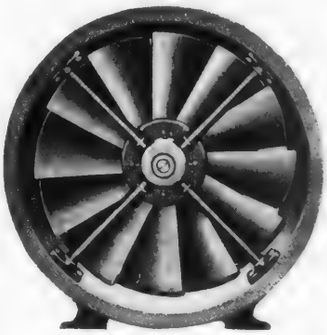
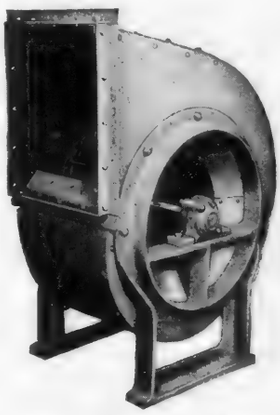
Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.



Pulley Driven Disc Fan for Mines

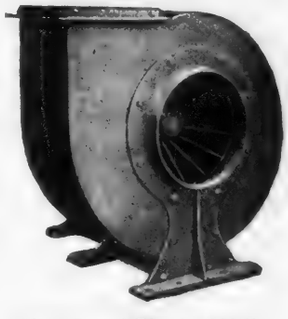
The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

Motor Driven Propeller Fan

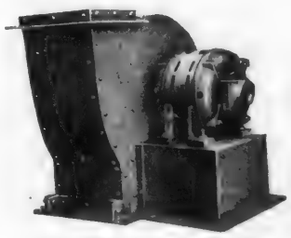


Slow Speed Planing Mill Exhauster

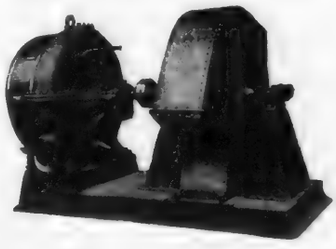
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

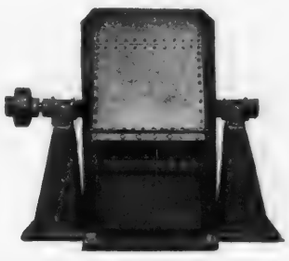
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

Cycloidal
MULTIVANE FANS
TRADE MARK

FULFILL THE OBLIGATIONS OF ENGINEERS AND CONTRACTORS TO THE USER.

Pat'd May 26, 1908

A GENUINE COMBINATION OF

EFFICIENCY *AND* DURABILITY

The result of over 40 years of constant experience

A fact that demands your attention:—

"WHEREVER INSTALLED"

Cycloidal Multivane Fans Receive Unsolicited Praise and Recommendation from Architects, Engineers, Contractors and Users.

Sectional Catalog No. 20 is yours for the asking. Contains Capacity tables, dimensions, etc.

GARDEN CITY FAN CO.

Established 1879

McCormick Bldg. CHICAGO, ILL.

COCHRAN & WRIGHTSON
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New York City

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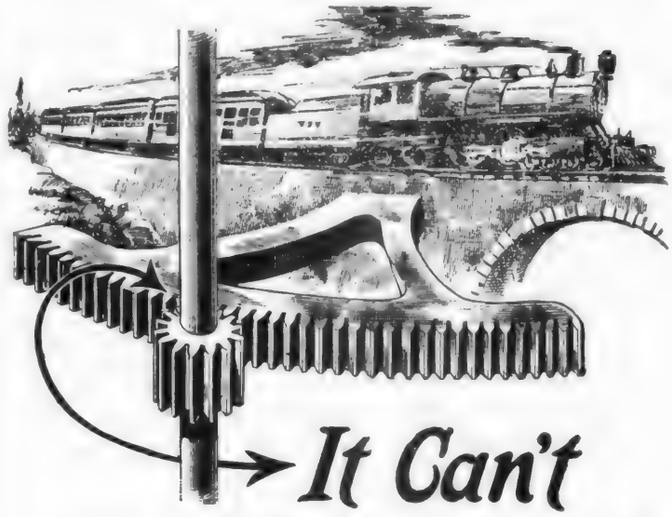

It Can't
run off the Track

An Engine backed a train of cars onto a siding on a hill. The tracks were *too short*. Off went the end cars.

This illustrates a fault commonly found in ordinary gauges. The segment is *too short* and it runs off the pinion when there is an overload. Then the gauge has to be returned to the factory for adjustment.

The wide segment in S & B Columbia Gauges permits a 50% overload without "running off." This extra factor of safety saves no end of trouble.

There is an obvious danger, too, in a short segment. Because in the critical moments when a gauge is suddenly put out of business and fails to record the pressure, boilers have been known to "let go," despite the safety valve.

There are many other reasons why S & B Columbia Gauges are the gauges for long, reliable service, as, for instance, the scientifically cut, accurately-fitting pinion and segment, the substantial spring, etc.,—all tending to greatly prolong the life of the gauge.

Our Book A-14 should be in the hands of everyone interested in Gauges. Write for a copy TODAY!

THE Schaeffer & Budenberg MFG. CO.

Makers of Columbia Recording Thermometers And Gauges with "TIME PUNCH"

Atlanta
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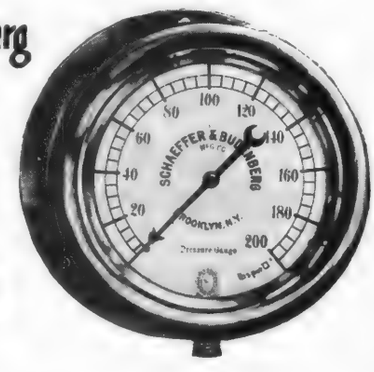


S&B Columbia Gauges

For Low-Pressure Work
MONSOON FANS

A

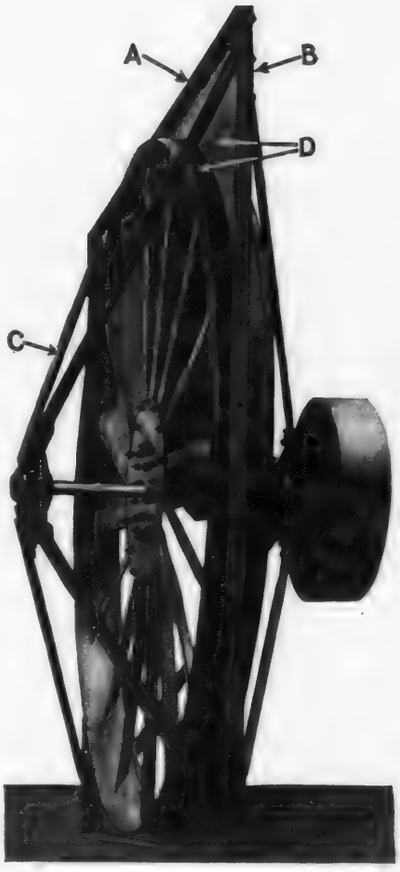
Sturdy frame of heavy angle iron, with mitered corners.

B

Heavy steel gusset plates, reinforcing corners, stiffening and making entire frame absolutely rigid.

C

Diagonal spiders of channel steel. Frame cross-braced by spiders running *straight* from corner gusset plates to center of fans. Substantial pyramid form of spider constructions takes up all weight, end thrust and vibration of fan in either tension or compression.



D

Heavy sheet steel circular casing, reinforced by angle iron ring.

Standard Equipment

SKF Self-aligning ball bearings and American Steel Split Pulleys.

Minimum Power----Maximum Capacity
Low Upkeep----Long Life

Sizes---3-ft. to 12-ft.

MONSOON COOLING SYSTEM, INC.

1476 Broadway New York, N. Y.

THE DOUGLASS HUMIDIFIER

STANDARD TYPE
Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

Inexpensive to install

Will not get out of order

No attention required

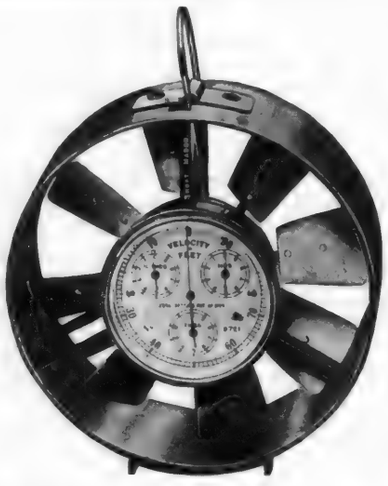
No maintenance expense

Made in various sizes and types to suit all conditions and requirements

Illustrated catalogue sent on request

THOMAS J. DOUGLASS & CO.
441 N. Dearborn St.
Chicago, Ill.

RADIATOR TYPE
Is attached to steam radiator in place of the air valve. Made in one size only.



Tycos **Anemometer**

Light, portable, always ready for instant service, a *Tycos* Anemometer can be used anywhere in large or small buildings for maintaining the highest efficiency and reducing costs of heating and ventilating.

Illustrative, descriptive literature on request

Taylor Instrument Companies
Rochester, N. Y.

"There's a *Tycos* or *Taylor* Instrument for every purpose"

812

Mel-Rock Air Washers

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MECHANICAL EQUIPMENT CO.,
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W. H. NIESTRATH,
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COCHRAN & WRIGHTSON,
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GARDEN CITY FAN CO.,
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MEL-ROCK PRODUCTS
TRADE-MARK

MELLISH-HAYWARD COMPANY
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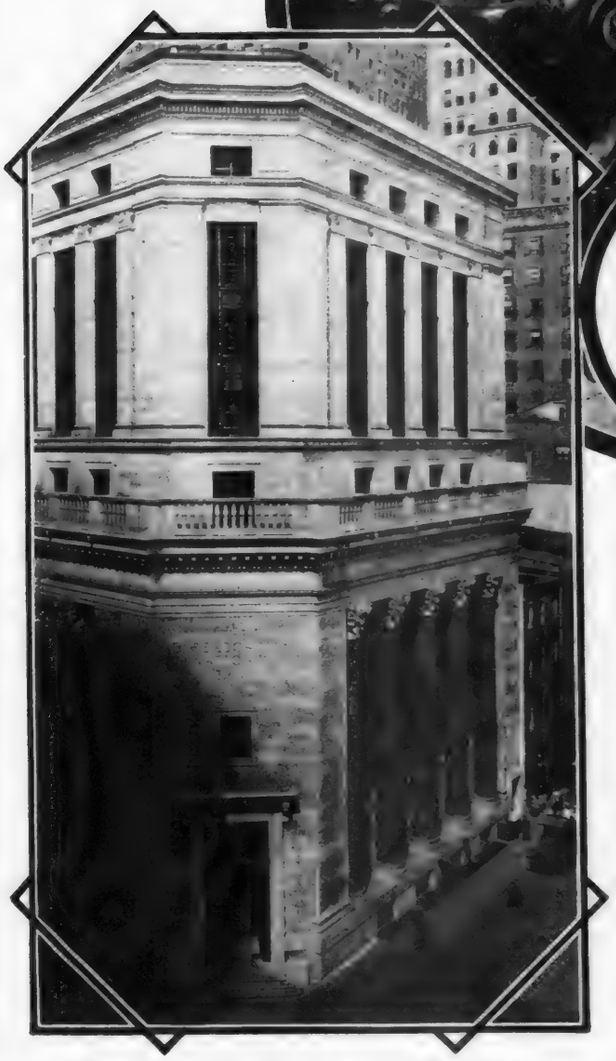
CHICAGO



Seaboard National Bank

THE selection of a ventilating motor for quiet, continuous operation always narrows down to a motor whose reliability is unquseitioned.

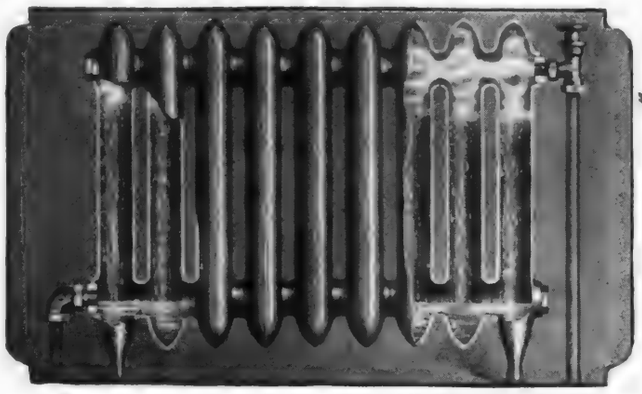
The Westinghouse ventilating motor is reliable because it has the experience of a complete pioneer electrical organization built into it.

Above is an installation of Westinghouse ventlating motors at the new Seaboard National Bank of New York.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.

Offices in all Principal American Cities

Westinghouse



Cross section of radiator as used in Adsco Heating. Adsco valve partly open. Note steam at top—air below. Note absence of air valves and traps.

No Overheating

20% to 30% Fuel Saved

Adsco Graduated Radiator Valve, which gives positive control of steam.

Note the positive control of steam by the Adsco Graduated Radiator Valve which allows any percentage of the upper part of the radiator to be filled with steam. It is not necessary to fill the entire radiator when small heating effect only is needed.

Note condensate which trickles down inside walls of radiator giving up heat to the air and leaving radiator so cool that return pipes need not be covered.

Adsco Heating uses no air valves, needs no radiator or return traps, vacuum pumps or other complicated devices—it can be installed inexpensively. It is easy to change hot water systems to Adsco Heating. Ask for Bulletin No. 159-H.

AMERICAN DISTRICT STEAM COMPANY
GENERAL OFFICES AND WORKS
NORTH TONAWANDA NY

AGENCIES:

First National Bank Bldg. CHICAGO | 1544 Woolworth Bldg. NEW YORK | Hoge Bldg. SEATTLE | 2A Park St. BOSTON | 1404 Arrott Bldg. PITTSBURGH

Ask about Adsco Heating for individual buildings, Bulletin 158-H; for Adsco Community Heating of a group of buildings from Central Station Steam Plant—Bulletin 20-H.

ADSCO HEATING

A Super-Regulator for Vapor Heating Work

POWER IS ITS MIDDLE NAME

Draft dampers are controlled with strong and steady graduated movement, accurately responsive to slightest change in boiler pressure, even to the fraction of an ounce.

A vapor or modulating system has a new meaning when hooked to the boiler with a

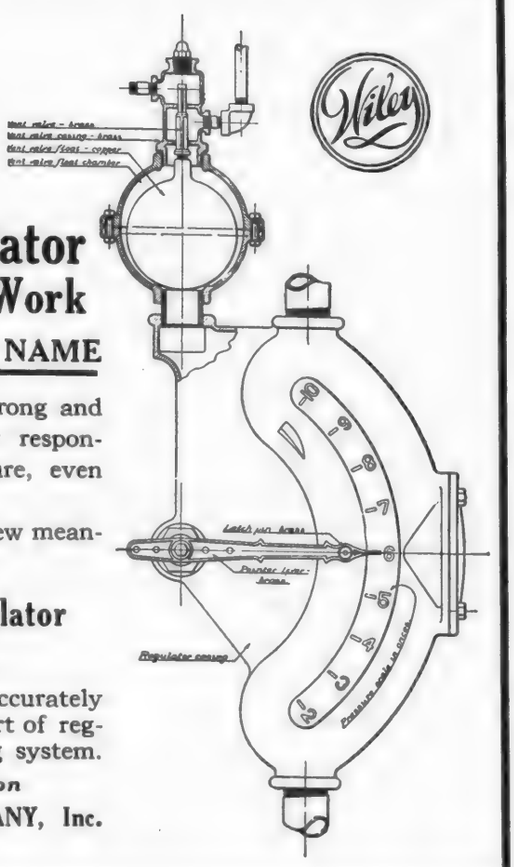
Wiley Safety Vent Vapor Regulator

built for lifetime service

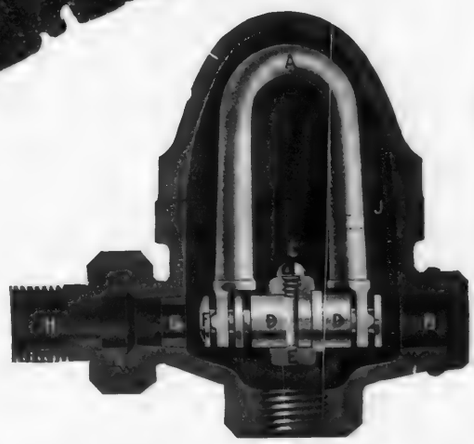
All working parts of cast bronze, accurately machined. Safety-Vent-Valve forms part of regulator and handles air from entire heating system.

Write for prices and full information

SIMPLEX HEATING SPECIALTY COMPANY, Inc.
LYNCHBURG, VA.



VENTO



Return Line Valve—

VENTO Return Line Valve, for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed.

VENTO is thermostatic in its operation and so simple that no part of it can possibly get out of order; so sensitive that a slight change of one degree in temperature will start the valve in operation.

VENTO automatically discharges air and water without loss of a particle of steam. It is by far the most efficient valve for its work ever produced.

It will exert more power and give a greater movement than any other thermostatic device in use. VENTO has proved more than a friend to thousands of heating men who found in it the solution of the most of their troubles.

Our latest Booklet, "The Perfect Heating Systems." will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
Philadelphia

How about the Saving You Make?

Government tests show that BANNER ROCK WOOL QUILT is almost twice as efficient as 85% magnesia.

Thus a saving of one ton of coal with 85% magnesia would mean practically two ton saved with Rock Wood Quilt.

Why not get in line for these extra dividends?

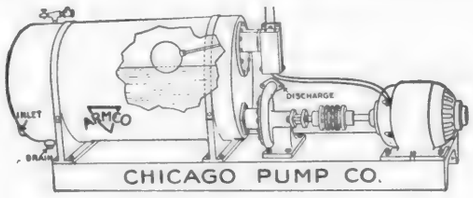
BANNER ROCK WOOL QUILT

100% FIREPROOF

INSULATION FOR HOT SURFACES

For Tanks, Tank Cars, Oil Stills, Water Stills, Heaters, Boilers of all Kinds, Boiler Breechings, Furnaces, Etc.

BANNER ROCK PRODUCTS CO., Alexandria, Ind.



Sure Return

Condensation Pump and Receiver Outfit

NAMED BY A USER

After all, test by trial is the only real method of determining true value.

Our contest for a name for this outfit was won by a user.

Standardized quantity production which allows superior construction at less cost to you, complete mounting and connections made on one base, lower operating cost, all are features of this outfit, and at a price no higher than any other.

Delivery on renewal parts can be made same day ordered.

Write for our specification data—it means money saved for you.

CHICAGO PUMP COMPANY

2325 Wolfram Street Chicago, Illinois

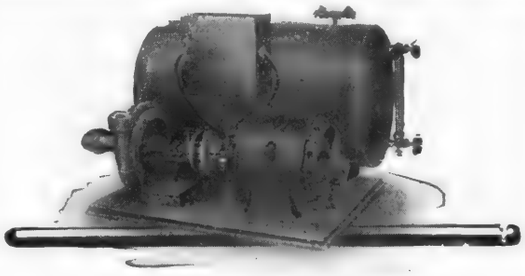


Fig. 2176

Automatic Electric Condensation Pumps

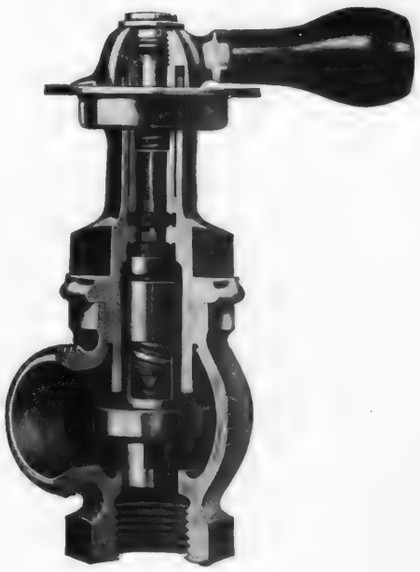
Economy Automatic Electric Condensation Pumps are compact, self contained. Constructed of highest quality materials obtainable. Simplicity and efficiency are the keynote of this design. The pump is bronze fitted, ring oiling, centrifugal type. The float is seamless copper, high pressure type. Everything is sufficiently strong to yield long life and light enough to make handling and installation easy.

ECONOMY PUMPING MACHINERY CO.

122-124 N. Curtis St. Chicago, Illinois

You are taking no chances when you specify

LAVIGNE PACKLESS QUICK-OPENING STEAM RADIATOR VALVE



Sectional View
Lavigne
Graduated Packless Valve

Made of the highest grade materials for rugged service.

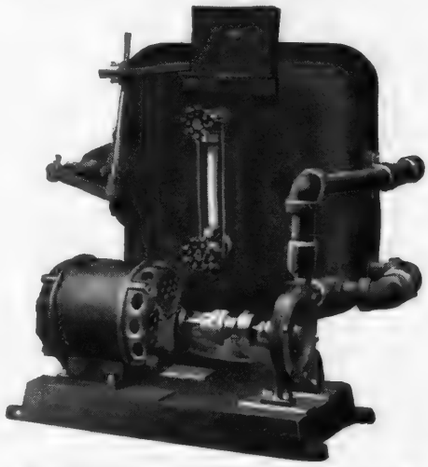
Six sizes, many styles of handles

All good jobbers handle them

COMMONWEALTH BRASS CORPORATION

Detroit, Mich.

WESTERN AUTOMATIC ELECTRIC CONDENSATION PUMP and RECEIVERS



RELIABLE **SIMPLE**

A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

Write for Bulletin No. 220

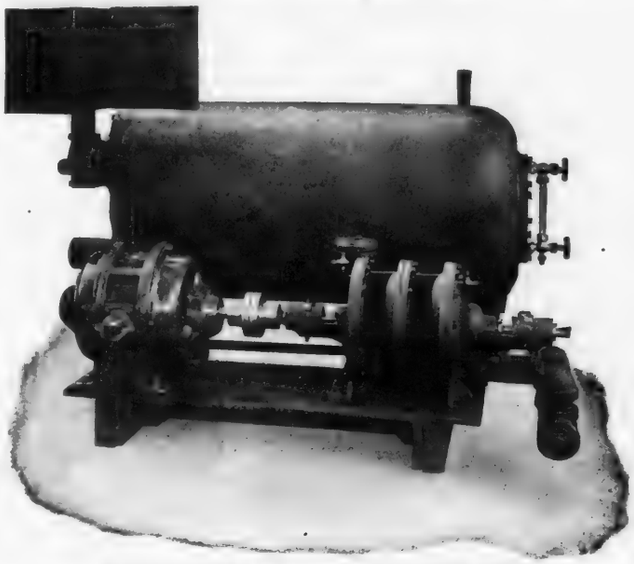
WESTERN ENGINEERING CO.
DAVENPORT, IOWA

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

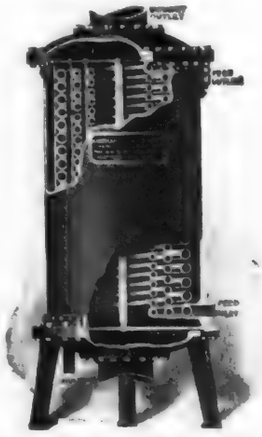
RUGGED **RELIABLE**

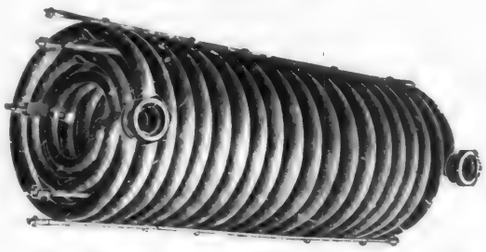
Constructed to insure long life.

Superiority proven by years of experience.

Send for Bulletin C-5100

YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.





The WHITLOCK Type A Industrial Heater

In sizes from 5 to 500 H. P.

SO constructed that the feed water comes in contact with nothing but copper—therefore there is no rusting or corrosion.

The *Type A* construction insures perfectly clean feed water uncontaminated by cylinder oil from exhaust steam.

Type A Heating Surface

consists of coils of pure seamless drawn copper tubing brought together into common inlet and outlet by our patented bronze manifolds. All joints are made by lapping and brazing—no threaded or soldered joints employed within the shell.

See Bulletin 13

THE WHITLOCK COIL PIPE CO., HARTFORD, CONN.

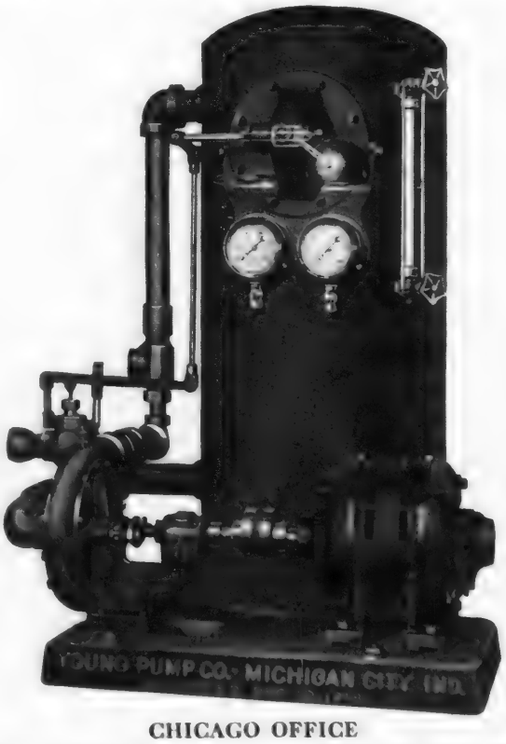
New York Chicago Philadelphia Boston Buffalo

"Whitlock Heaters Have Everlasting Copper Tubes"

Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

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WERE GOOD 20 YEARS AGO

Are Still BETTER Today

Always Use Sprague in Your Ventilating System

Sprague Blower Outfits Still Operating at Macy's Dept. Store. N. Y. City, where they were Installed when Building was Erected some Twenty Years Ago.

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Of General Electric Company
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KENNEDY
RENEWABLE-DISC RADIATOR VALVES

Unfailing reliabilty of service, reasonable prices and the guarantee of satisfaction that a long established company is able to furnish, make Kennedy Radiator Valves the best buy for steam and hot water service on the market.

We can honestly recommend them for use anywhere, and invite a close scrutiny of those points of design and construction that set them apart as decidely superior. They come in every desirable type—straightaway, angle, offset, corner, etc.

Other Kennedy Valves for handling water, steam, oil, acids, gas, alkalies, etc., in more than 500 distinct types and sizes are at your service. Our catalogue illustrates and lists them all. Send for a copy.

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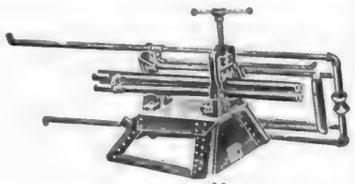
Sales Offices: Philadelphia, Continental Hotel Bldg.: Kansas City, 208 Mutual Bldg.; Seattle, L. C. Smith Bldg.; Salt Lake City, 503 Dooly Bldg.; El Paso, 704 Two Republics Bldg.

145

Efficiency and Economy



are two necessary essentials for progress in every shop

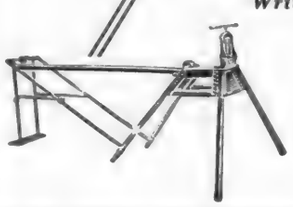
Can be assembled in a few moments and conveniently carried to any job.

USE THE

MARTIN
Portable Vise Stand and Pipe Bender
(Combined in one)

Insert legs in sockets—no nails, screws or fastening required.

Furnished with or without legs in both the large stand with chain vise for 4 in. pipe and hinged vise for 4½ in. pipe. Also smaller stand for lighter pipe.



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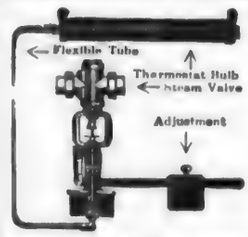

The Powers Regulator No. 15
Specially adapted for control of air temperatures in leather dryers, ovens and kilns. Write for Bulletin No. 138. There are other Powers Regulators for other places—acid baths, hot water tanks, etc.

Wherever there is need for maintaining a definite uniform temperature—as in drying rooms, ovens, vats, kilns, etc.—men may forget—but machines cannot. You depend on your men to watch the temperatures but they are only human and, as careful as they try to be, they have sometimes allowed valuable hides to be spoiled.

The Powers Automatic Heat Regulator

Built scientifically in accordance with known physical laws. Self contained; entirely automatic; can be adjusted to maintain any desired degree of heat; stays on the job every minute and does not **forget** to "turn 'er on" or off when the temperature even **approaches** the danger point. Prevents loss and damage and worry. Set the Powers Regulator and you can **depend** on results.

THE POWERS REGULATOR CO.
Specialists in Automatic Heat Control

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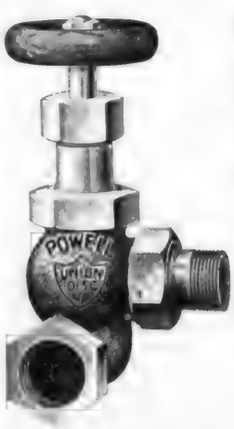
Powell Valves

UNION COMPOSITE DISC VALVE

UNION DISC RADIATOR VALVES



Offset corner with male union

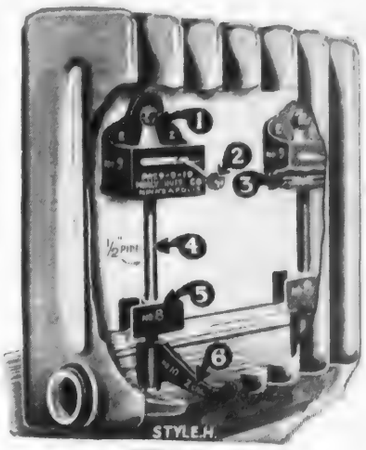
Made to suit every Requirement, with Unions and wood wheels, in Globe, Angle, Corner and offset patterns.

NOTE THE UNION BONNET CONSTRUCTION
Specify
"POWELL"
VALVES

Ask your dealer for Powell Valves or write us

The Wm. Powell Company
Cincinnati, Ohio

SIX IMPORTANT FEATURES of *E-Z* RADIATOR HANGERS



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1. One Bolt
2. Invisible Washer
3. Horizontal Adjustment
4. Vertical Adjustment
5. **Adjustable for Baseboard**
6. Made for Wall, and Column Radiation

STYLE R
Without Baseboard Adjustment
Reasonable Price

Made for all styles of radiation

Manufactured by
HEALY-RUFF CO.,
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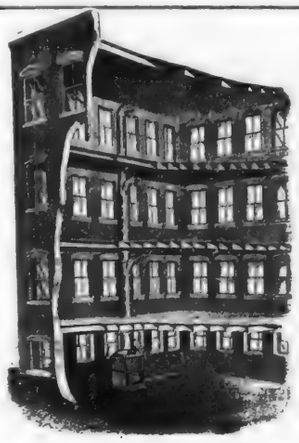

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Adapted for heating and ventilating large buildings. No need of distributing pipes. Takes full advantage of the laws of nature in the production of warmed air and utilizes these laws in providing an even distribution of warmth and comfort throughout the largest of buildings.

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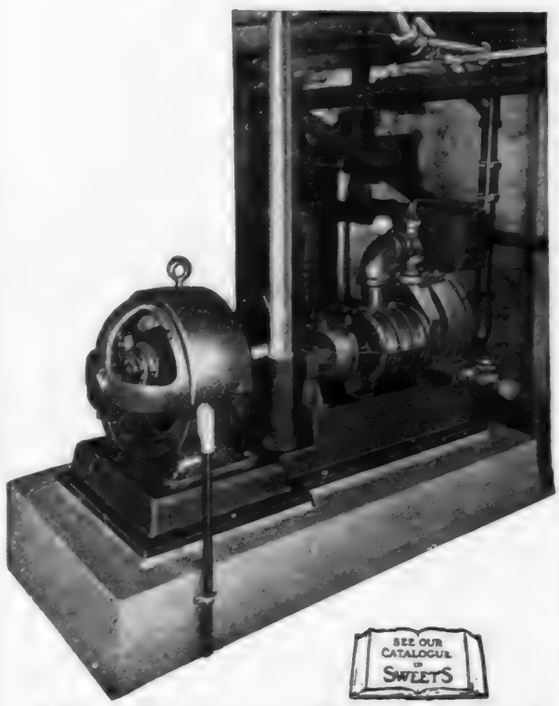

All Dirt is Discharged Direct to the Sewer

No buckets to empty—no germ-laden dust to handle—these features make Connersville vacuum cleaners most efficient and sanitary.

All dirt travels direct to the sewer from the cleaning tool, through the medium of the patented Connersville centrifugal separator. Tanks of all kinds are dispensed with.

These cleaners are made in all sizes to meet every cleaning problem. There are Connersville representatives in the principal cities to assist you in your vacuum cleaning problems.

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U. V. A. Div. Dept. C
CONNERSVILLE, INDIANA

P Preferred by those who recognize true merit in a water Heating System

A Automatic, requiring no adjustment — and no attention whatever

T Temperature is uniform under all variations of service

T Time is saved by having an unlimited supply of scalding **hot water**

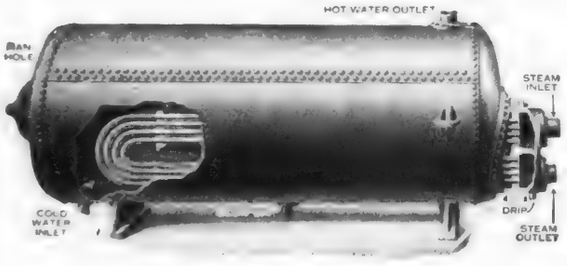
E Efficient and economical. Materials and workmanship unexcelled

R Reliable with nothing to get out of order and cause trouble and delay

S Steam may be either exhaust, high or low pressure live steam

O Operating cost is next to nothing no difference how long in use

N Noted for supplying **Hot Water** for domestic or industrial purposes



The Patterson System of Water Heating for any Service

Patterson-Kelly Co.
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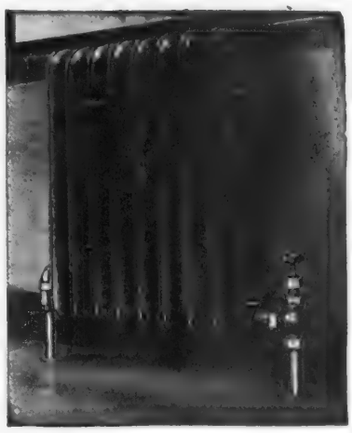
RADIATOR BRACKETS



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LABOR SAVED

NO WALL STRIPS

NO BREAKAGE

NO DIRT

INEXPENSIVE

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SHEET METAL CONSTRUCTORS
985 Dean St., Brooklyn, N. Y.

OPPORTUNITY EXTRAORDINARY

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AT AUCTION

By Order of the Secretary of WAR

We are authorized to sell at auction, Camp Lee, near Petersburg, Va. Sale will begin February 6th and continue until completed.

Here is an opportunity for the small buyer to purchase at his own figure such items as he may need.

60,000,000 feet of Lumber, 200,000 square feet of Radiation, 13,000 units of Equipment, 2,400 Buildings, 150 miles of Electric Wiring and many other items.

For free catalog showing inventory, terms and conditions of sale, write—

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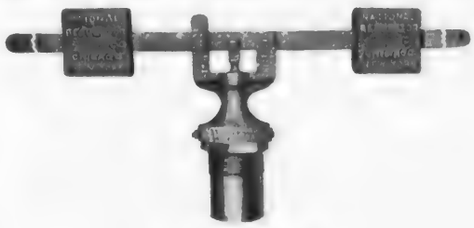
D. C. CLARKE PRESIDENT STARKS BLDG. LOUISVILLE, KY.

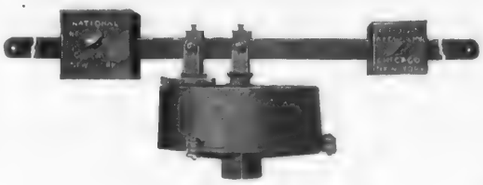
LOCAL OFFICE

Camp Lee Virginia

HOT WATER LOW PRESSURE



2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

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Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

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VAPOR

A-JACKS for HIGH PRESSURE

SPENCER Magazine Feed HEATERS

A Spencer Heater will operate for years without repairs.

Consider the long life of a Spencer Heater—we know of places where they have been in seasonal use for 10, 12 and even 15 years without a single repair—tubes still in first-class condition.

Then remember that Spencer Heaters burn Buckwheat Coal and no more of it than other heaters burn of larger, more expensive coal.

Again there is the magazine feature—attention once in 12 to 24 hours is enough, and the Spencer will give an even heat the whole day long.

Now, the next time you have a heating job, recommend a Spencer Magazine Feed Heater. If we can be of any service to you we have representatives in New York, Boston, Philadelphia, Baltimore, Buffalo, Detroit and Chicago.

Successfully Burns No. 1 Buckwheat

STANDARD HEATER COMPANY
Williamsport, Pa.

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

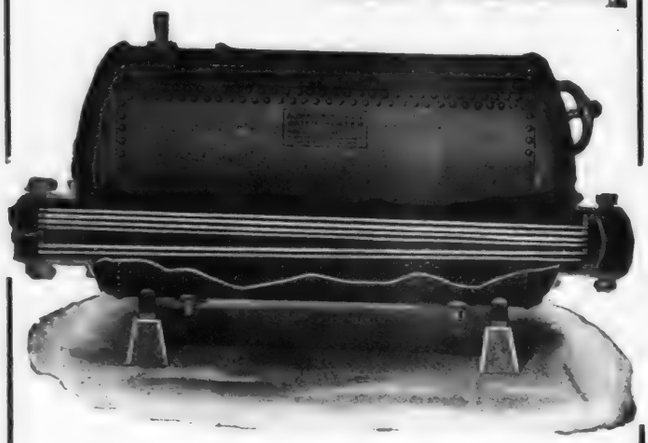
DAHLQUIST

Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

OUR REPUTATION IS BEHIND THE ALBERGER "BUFFALO" STORAGE WATER HEATER



We would not risk this reputation by placing an untried product on the market. We make the experiments in our own shop and not in our clients' buildings. Our improvements are something more then experiments, they are accomplishments. Catalog No. 3 will give you a few interesting facts about heaters. Write for it.

Alberger Heater Company
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New York Offices: 1544 Woolworth Building

STERLING SYSTEMS

THE STERLING SYSTEM OF VAPOR HEATING means The Highest Quality of

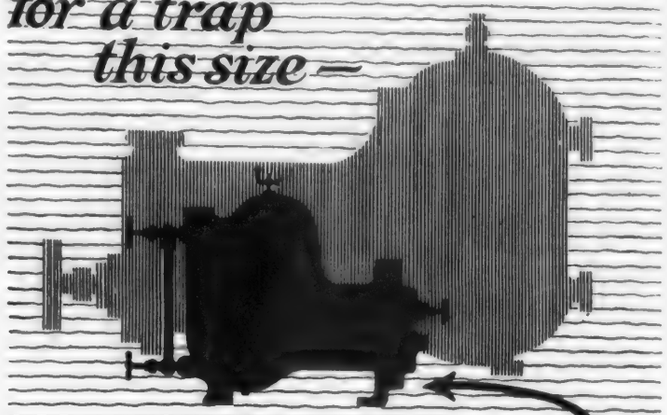
THERMOSTATIC RADIATOR TRAPS
PACKLESS RADIATOR SUPPLY VALVES
AIR ELIMINATING DEVICES
DAMPER REGULATORS
and
RETURN TRAPS

Coupled with highest quality of Engineering Service insuring a closed system of Vapor Heating of the highest possible efficiency.

Write for bulletins No. 32, Sterling System of Vapor Heating. No. 33, Sterling System of Vacuum Heating.

STERLING ENGINEERING CO.
419 - 3d Street, Milwaukee, Wis.
Manufacturers of Vacuum and Vapor Heating, Specialties.

Why pay more for a trap this size—



—when one this size does the work?

The capacity of a steam trap is determined by the size of the *discharge-valve orifice, not* by the size of the outlet *pipe*.

In ordinary traps this orifice is *very small in relation to the size of the trap itself,* so that, in order to get a trap that will discharge the condensation rapidly enough, you have to buy one that is *big out of all proportion to the work it does!*

And the larger the trap, the more it costs.

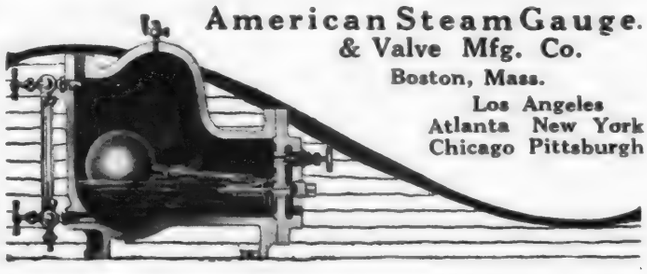
AMERICAN IDEAL STEAM TRAP

has *a valve-orifice much larger than the ordinary trap* for an inlet of a given size. Hence a *small* American Ideal will do the work of a *much larger* and *much more expensive* trap of the ordinary make.

No other trap has the valve mechanism necessary to operate such a large valve opening under high pressure. The 60 to 1 leverage of the American Ideal valve mechanism opens this bigger valve with ease.

The *power* to operate the lever mechanism lies in the extra large float, made of heavy, seamless copper, which is guaranteed for the life of the trap.

Anyone who reads our trap manual, "A Steam Trap Catechism," will instantly grasp these and other features which make the American Ideal the premier of all steam traps. Write for a copy today.



American Steam Gauge & Valve Mfg. Co.
Boston, Mass.
Los Angeles
Atlanta New York
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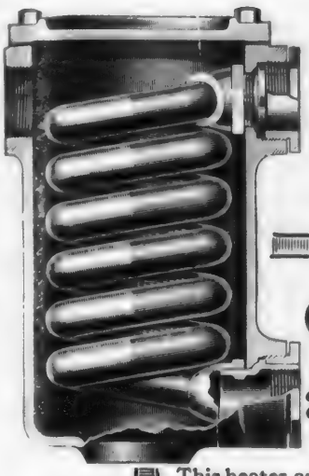


EXCELSO

Constant Supply of Hot Water at Lowest Possible Cost

This heater asures the satisfaction of a **steady supply**, at no extra cost for gas or other fuel, by installing the Excelso—for steam and vapor-heating systems. **Replaces the inefficient fire-pot coil.**

THOUSANDS IN USE

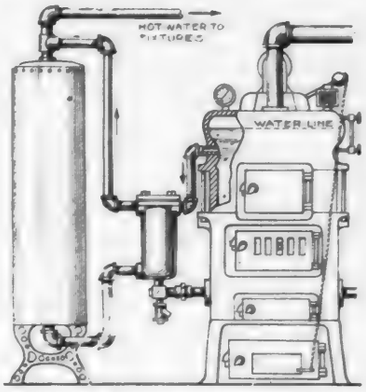
Endorsed and SOLD by the following Boiler Manufacturers. What Higher Endorsement Could You Ask?

American Radiator Co.	Burnham Boiler Corp.	Boynton Furnace Co.
Richardson & Boynton Co.	Pierce, Butler & Pierce Mfg. Co.	The Wm. H. Page Boiler Co.
Richmond Radiator Co.	United States Radiator Corp.	Gurney Heater Mfg. Co.
Standard Heater co.		Abendroth Bros.
Utica Heater Co.	International Heater Co.	Thatcher Furnace Co.

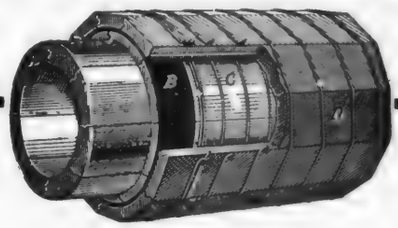
Also by Plumbing and Heating Jobbers Everywhere

Write for details, prices and discounts. Excelso dealers enjoy steadily increasing business.

EXCELSO SPECIALTY CO.
117 Clinton Street Buffalo, N. Y.
Special N. Y. City Sales Representative, JOHN G. KELLY, 137 E. 43rd St.



Typical Installation



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

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A. WYCKOFF & SON CO.
ELMIRA, N. Y.

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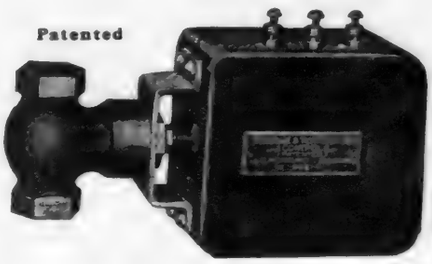

The
HORNUNG
Magnetic Valve

This is the little valve used as a pilot on all sizes of HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES. It has many other uses.

Ask for Catalogue No. 14

CENTRAL HEAT APPLIANCES
J. C. HORNUNG
343 South Dearborn St. Chicago

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American Blower Co., Detroit, Mich.
American Moistening Co., Boston, Mass.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
Monsoon Cooling System, Inc., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Autovent Fan & Blower Co., Chicago, Ill.
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Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
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Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Standard Heater Co., Williamsport, Pa.
Titusville Iron Works Co., Titusville, Pa.
Utica Heater Co., Utica, N. Y.

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The Brownell Co., Dayton, O.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.

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Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Works Co., Titusville, Pa.

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Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

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Simmons Co., John, New York.

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Alberger Pump & Condenser Co., New York.
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Griscom-Russell Co., New York.
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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

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Sixth City Sheet Metal Works, Co., Cleveland, O

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Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Griscom-Russell Co., New York.

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Hersh Brothers Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Hersh Brothers Co. Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.

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New York Blower Co., Chicago, Ill.
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American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Griscom-Russell Co., New York.

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McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Surtevant Co., B. F., Hyde Park, Boston, Mass.
Wright-Austin Co., Detroit, Mich.

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Alberger Pump & Condenser Co., New York.
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Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

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American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co,. New York.

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Johns-Manville, Inc., New York.

Feed-water.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

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American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

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Crane Co., Chicago, Ill.
Jenkins Bros., N. Y.

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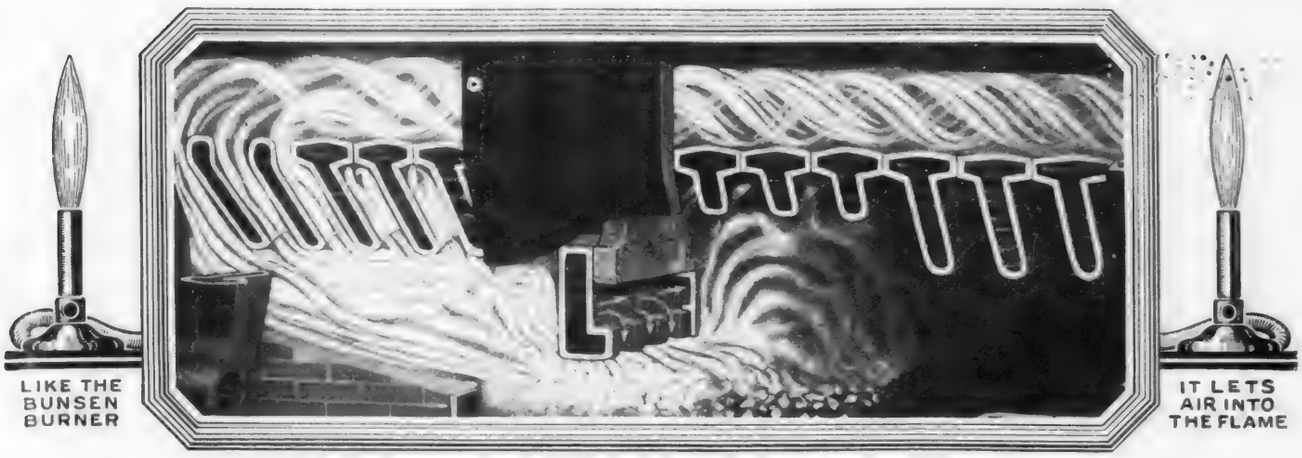

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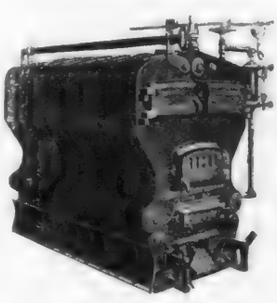

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McAlear Mfg. Co., Chicago, Ill.
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Wright-Austin Co., Detroit, Mich.

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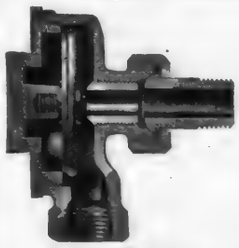

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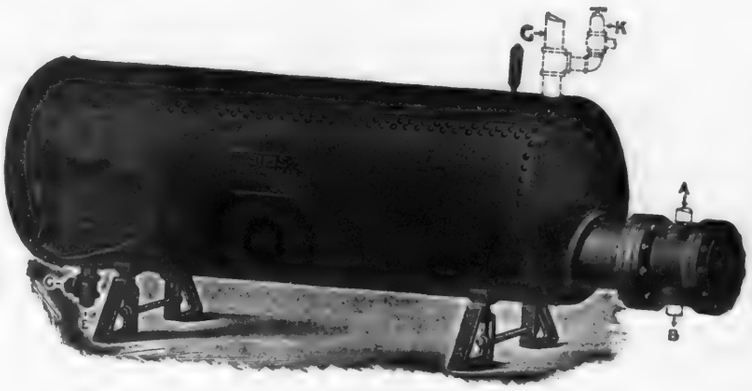

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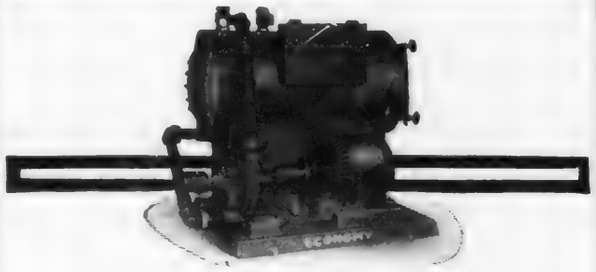

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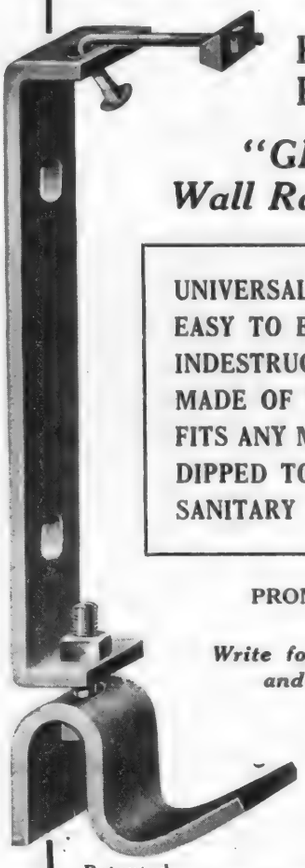

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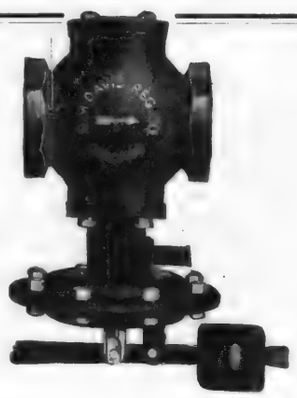

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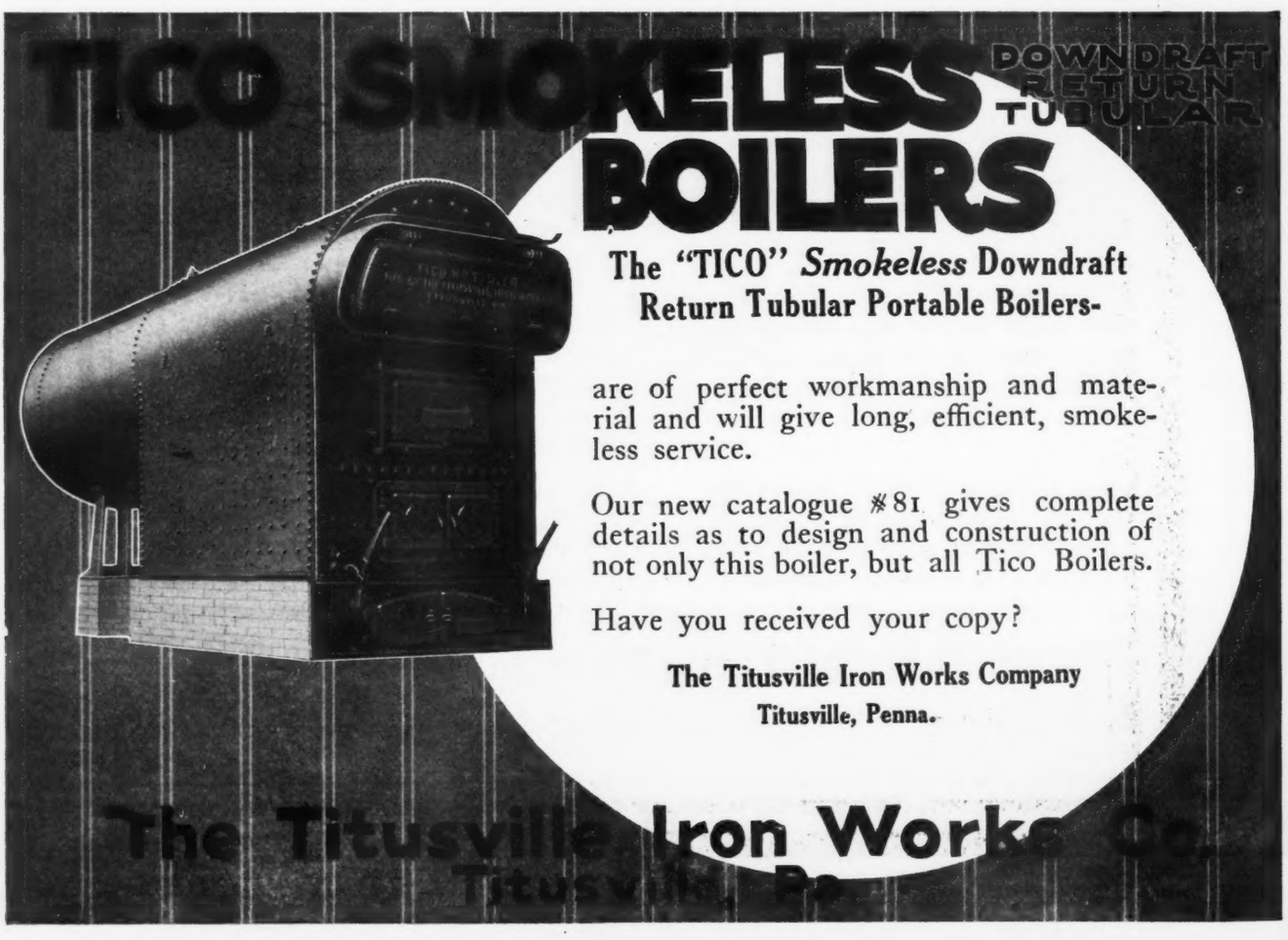
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